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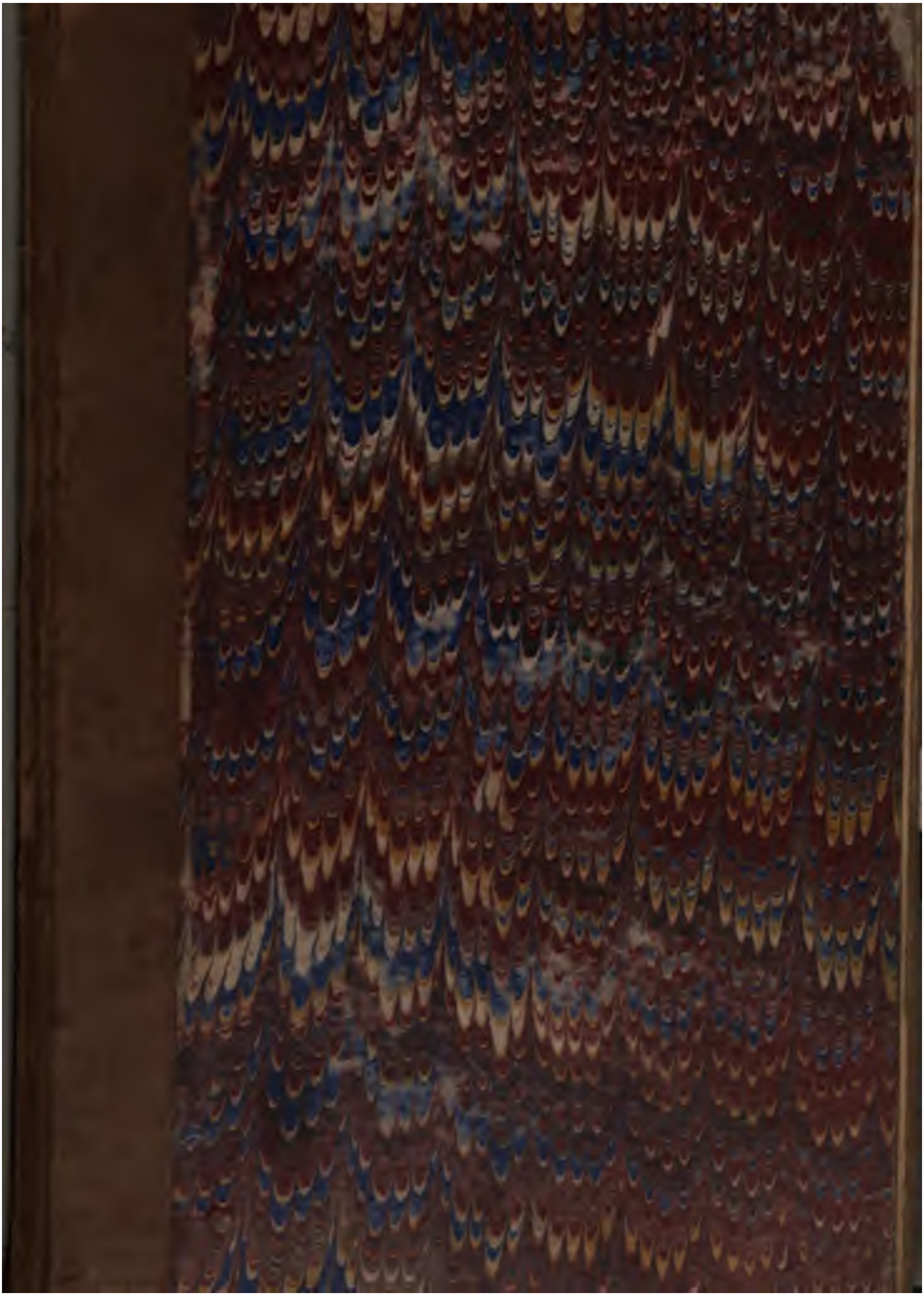

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pt. 6/i–iii

ABRIDGMENTS

OF THE

Specifications

RELATING TO THE

MANUFACTURE OF IRON AND STEEL.

IN THREE PARTS.

WITH INDEXES OF NAMES AND SUBJECT-MATTER.

PRINTED BY ORDER OF THE COMMISSIONERS OF PATENTS.

32

LONDON:
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PREFACE.

THE Indexes to Patents are now so numerous and costly as to be placed beyond the reach of a large number of inventors and others to whom they have become indispensable.

To obviate this difficulty, short abstracts or abridgments of the Specifications of Patents under each head of Invention have been prepared for publication separately, and so arranged as to form at once a Chronological, Subject-matter, Reference, and Alphabetical Index to the class to which they relate. As these publications do not supersede the necessity for consulting the Specifications, the prices at which the latter are sold have been added.

Part I. contains Abridgments of the Specifications of the Patents that had expired when that Part was published, from February 1621 to March 1843, inclusive.

Part II. contains Abridgments of the remaining Specifications enrolled under the old law.

Part III. contains Abridgments of the Specifications filed under the new law, from 1852 to June 1857, inclusive.

Many Specifications were still unpublished when these abstracts were made, and the titles of the Patents, which are frequently defective, formed in many cases the only guide which could be followed in discriminating the subjects to which they related; an occasional omission may therefore, have been caused, for the titles are not only vague, but sometimes tend to mislead the search. In the Appendices are contained the Abridgments of five Specifications of Letters Patent granted to William Johnson, Prince Rupert, William Furness, and John Crowley, which were previously omitted.

All the Specifications, both of the old and new Letters Patent, as well as the Provisional Specifications deposited under the new law, are now printed and published, and defects which may be still existing will be remedied when this series is re-issued.

B. WOODCROFT.

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MANUFACTURE

OF

IRON AND STEEL.

A.D. 1621, February 21.—N$_o$ 18.

LORD DUDLEY (EDWARD).—"The misterie and arte of meltinge iron ewre, and of making the same into cast workes or barrs with sea coles or pit coles in furnaces with bellowes."

Lord Dudley seems to have been the first successful patentee connected with the manufacture of iron. The gradual exhaustion of the supply of wood from the forests in England led naturally to the substitution of some other fuel for charcoal. In 1612 one Simon Sturtevant obtained a Patent from King James I., for thirty-one years, for the manufacture of iron with pit coal in all its branches, and in return for the grant of the Patent, he was bound to publish an account of his discoveries, which he afterwards did in a 4to book, called his "Metallica." His process however appears to have failed when tried on a large scale, and he surrendered his Patent in the following year.

The second inventor in this branch was one John Stevenson, who obtained a Patent for similar manufacture to Sturtevant's and on like terms, that he should publish an account of his discoveries, which he did in his "Metallica," printed for Thomas Thorp, A.D. 1613. Stevenson also seems to have failed in putting the invention in practice, and surrendered his Patent, as did several other unsuccessful imitators. In 1621 Lord Dudley obtained his Patent, of which an account is given by his son Dud Dudley in his "Metallum Martis." Lord Dudley was only able to make iron at the rate of three tons per week; but so important did his invention appear, that in the celebrated statute of 21 James I. chap. 3, abolishing the grant of monopolies, this Patent was specially exempted from its operation. Lord Dudley met with much opposition from rival manufacturers, and his Patent was limited to a duration of fourteen years, while others, like Sturtevant, obtained a we have seen a grant of thirty-one years. Unsuccessful attempts were made to evade his Patent by using pit coal to heat melting-pots in which the ore was placed. Lord Dudley's invention was not followed up by other improvements, owing to the civil wars and prolonged disturbances with which the country was afflicted.

[No Specification enrolled. Referred to in Webster's Pat. Cases, vol. 1, pp. 14—16; Mushet Papers, pp. 401—403. No Specification of any Patents relating to iron are found enrolled prior in date to A.D. 1727, No. 490, Fallowfield.]

A.D. 1627, March 20.—N° 38.

ASTELL, COPLEY, and CROFTS.—" A peculiar misterie, arte, " way, and means for melting of iron ore, and for making the " same into cast workes and barres with sea-coales and pit coales; " with prohibicion to all others from doing the like, paying into " His Ma$^{ty's}$ receipt from Xmas, 1629, during the residue of the " terme of xiiij yeares then to come, the yearely rent of 400^{li}."

The condition of paying a yearly rent to the King for a Patent was not unusual at the date of this Patent, but the large amount shows that the manufacture was one of great importance.

A.D. 1630, August 13.—N° 51.

BALL, LASSELLS, HAMPTON, and AULEY. — Melting, making iron, &c. with "peate or turfe" properly prepared for fuel.

[Ref. Ind. p. 11; Appen. p. 13.]

A.D. 1632, December 7.—N° 61.

JORDEN, Edward, D̃cor in Phisicke. — Melting tin, iron, &c, "with pit coale, peate, and turfe." The Doctor was bound to pay 6*s*. 8*d*. yearly to the King.

[Ref. Ind. p. 13.]

A.D. 1635, June 25.—N° 83.

FRANCKE, Thorneffe. — Furnaces for melting iron, &c., " whereby the annoyance of smoake is much avoided." The patentee was bound to pay three tenths of the profits of his invention to the King.

[Ref. Ind. p. 18; Appen. 17.]

A.D. 1636, April 22.—N° 91.

VERNAT, PHILLIBERT, Knt. — Making and working iron. The patentee was bound to pay to the King a tenth of the profits of the invention.

[Ref. Ind. p. 19; Appen. p. 17. 2nd Pat. No. 113; Ref. Ind. p. 27.]

A.D. 1651, March 1, Jeremy Buck, by a special Act of Parliament, obtained a patent for making iron with stone coal, pit coal, or sea coal without charking. Infringers were to forfeit a 10*l*. penalty for every infringement. See Webster's Pat. Cases, vol. i. p. 35.

Nos. 117, 129, 161, 162, 170, 198, 291, 363, 460, 489, have all reference to the manufacture of iron, but no Specifications of these or of any of the above-mentioned prior patents having been enrolled, no information can be given as to the particulars of the several inventions.

A.D. 1727, February 9.—N° 490.

FALLOWFIELD, WILLIAM.—Smelting down "iron oar" with "fewel different from what has been used before," and making the same into bar-iron.

Peat, dried in the sun or in a kiln, is to be charred. And the charred peat with a small proportion of charcoal is used in smelting the "oar." "Fine earth resembling bole armoniack and a white sand" which is used instead of lime in some places for plaistering, with some marl may be used when required; and also "limestone & and clay impregnated with iron. With the same "fewel the pig iron is refined & drawn into barrs or other shapes, "and the barr iron is converted into steel."

[Printed, 3*d*.]

A.D. 1728, September 18.—N° 502.

WOOD, WILLIAM.—Making raw iron or iron metal prepared in an air furnace with pit coal, whereby the nation may be supplied with all the iron it requires "& prevent the buying of iron "from foreign parts, which amounts to about twenty thousand "tons yearly, and is most paid for in ready money, to our great "disadvantage and loss."

No Specification was enrolled.

[Ref. Ind. p. 91; Appen. p. 72.]

A.D. 1728, November 21.—N° 505.

PAYNE, John. — Machinery for obtaining motive power by atmospheric pressure acting upon vanes used for ventilation. Improved furnaces and boilers for applying heat. Improvements in the manufacture of iron and salt.

The improvements in the manufacture of iron consist "in "putting certain ingredients into fusion with pig or sow iron; "videlicet, the ashes of wood and other vegetables, all kinds "of glass and sandever, common salt and rock salt, argile, "kelp, and pot ash, slegg or cinders from iron furnaces, and "forges, proportionable parts of the said ingredients being put "into fusion or melted with pig, sow, or other brittle iron, "which will make the like change as charcoal does in the fire "called the finery in common forges, and will render the same "into a state of malleability, as to bear the stroke of the "hammer, to draw it into barrs or other forms att the pleasure "of the workman, and those or other barrs being heated in the "said meltĕd ingredients in a long hott arch or cavern, as here-"after is described; and those or other bars are to pass between "two large mettall rowlers (which have proper notches or furrows "upon their surfass), by the force of my engine hereafter described "or other power, into such shapes and forms as shall be required." The engine consists of a large vane wheel hung in a frame in the side of a building, the pressure of the in-current of air being directed upon the extremities of the vanes. The furnaces are constructed in a series of "arched caverns;" at the mouth of the first the fire is placed, the matter to be heated or melted being placed in the interior of the arched caverns, and boilers or evaporating pans being placed over them. The "fiery particles" and heated air are confined in the first cavern, and there act upon the materials placed therein to be melted, and are then conducted by "flews" into the other arched caverns of the series to heat the materials placed therein. "Lastly is described the method of "moulding or shaping the scoria or dross of divers mettalls and "ores by fusing or melting, as before specified, with such mix-"tures as will in a great measure prevent its being brittle, and "also gives it divers colours, so as to make it the more orna-"mentall and usefull where other ponderous and vitrified matter "is wanting, which scoria or dross, when prepared, is to be "placed in moulds, and pressed down by a screw or weight soe "as to fill the moulds tothe proper shape designed for it."

[Printed, 3d. *Referred* to in the Rolls Chapel Reports, p. 118.]

A.D. 1736, March 20.—N° 553.

EYRE, Kingsmill. — Making raw iron in air furnaces by additional fluxes and a new method.

" The ironstone or ore being calcined, and the coal charked, " are pulverized and mixed together, and put into an air fur- " nace with the additionall fluxes of lime and the ashes of fern, " which thinns the slag, and causes a ready separation of the " metal, when it begins to come into the nature of iron. There " is then added, according to the quality of the ironstone or ore " melted, whether red short or cold short, or the sort of iron to " be produced, a certain small quantity of old rusty iron called " scraps, or bushel iron, or nut iron, or hammer slough," whereby more metal is extracted out of the iron than it yields without that addition. It expedites the operation in the furnace, saves fuel, and meliorates the iron, bringing it to a greater degree of fineness and softness than usuall.

[Printed, 3*d*. Referred to in Rolls Chapel Reports, 6th Rep. p. 120.]

A.D. 1761, February 5.—N° 759.

WOOD, John.—" A way of making malleable iron from pig " or sow metal commonly called cast iron, by a method entirely " new." In " converting " brittle cast iron into a malleable " state," several operations are performed, some " preparatory," others " peculiarly essential." " The preparatory operations are various," according to the nature of the cast iron, and " the inten- " tion of the operator to make the malleable iron hard or soft " or " of other required qualities.

The fuel used is "raw pitt coal," and the conversion into malleable iron is performed in closed vessels.

The pig iron, when prepared by the modes of preparation hereafter mentioned, is put into close vessels of clay or other fire-resisting substance, and mixed with certain fluxes mentioned hereafter. The charged vessells being hermetically sealed, are placed in an air furnace, and their contents are melted, the fluxes and impurities form slag, and " the iron is brought into a tough and malleable state," and then is wrought into bars under the forge hammer.

The preparatory operations are,—

1st. " I take pig or sow iron." " This I flourish or heat and work in a com̄on finery, with a blast " and coal fire until it is refined and "brought near to a malleable state," or brought to nature. It is then melted in the close vessels above described.

2nd. "To the iron thus flourished I sometimes add a due pro-" "portion of small pieces of malleable iron, when the cast metal" is very brittle, and the coals very sulphureous.

3rd. "I also take the same cast metal, and melt it down in an "air furnace," and then I reduce it "into small grains (accord-" "ing to art) by pouring it into water upon a wheel or roller "turned briskly round. The granulated metal" is "mixed with "various fluxes, according to its nature and the uses for which "the iron is intended, as with iron slag or cinder, scaled or scoria "of iron, fuisible sand and lime, kelp, soaper's waste." The "fluxes or additions "I put with the granulated metal into close "vessells, and work" in the air furnace, as above described.

4th. The cast iron is sometimes "formed into thin plates," which are broken "into small pieces, and put into the pots," with "due proportion of fluxes," and so "reduced to a malleable state."

[Printed, 3*d*. Another Patent, No. 794, was taken out in 1763, for improvements on the invention herein described.]

A.D. 1762, October 25.—N° 780.

ROEBUCK, John.—"A way of making malleable iron from "cast iron."

The cast iron is melted in a hearth with a blast, and the metal "worked" until it is "reduced to nature." It is taken out of the fire, separated into pieces, and then exposed to the "action of a "hollow pit-coal fire heated by the blast of the bellows, until it "is reduced to a loop," which is "drawn out under a forge "hammer into barr iron."

[Printed, 3*d*.]

A.D. 1762, December 13.—N° 783.

KNIGHT, James.—"A new method of making and drawing "iron, &c."

The pig iron and loop or ball of hot iron are made in the usual way, but the loop or ball is squeezed in "a screw engine "or slitting press." The screw is worked by a heavy fly in a kind of chest or box, in which are also fixed the cutters. The screw flattens the ball, and the cutters chop or slit it into blooms, which are forged with a hammer of the Patentee's invention.

[Printed, 3*d.*]

A.D. 1763, July 29.—N° 794.

WOOD, John and Charles. — Making cast iron malleable, without charcoal or blast, in an air furnace.

The invention is described as an improvement on that of John Wood's, of 1761 (N° 759).

The pig iron is either granulated by being poured hot into cold water, or pounded with heavy stampers. Scull or cinder is pounded in like manner.

If the iron be of red short quality it is sprinkled with strong lee of kelp, and then flourished or melted in closed pots with proper fluxes, such as slag scales or scoria of iron, sand, lime, kelp, or soapers' waste.

If this operation does not sufficiently flourish or reduce the iron to nature, it is again broken by the stampers, and flourished a second or third time.

The iron is then again pounded, and sometimes mixed with pure scull or scrap iron, and is fit for chaffing or melting in the close pots, with a covering of clay, when it becomes "perfectly "tough and malleable," and is to be "wrought under the "hammer into half blooms."

[Printed, 3*d.* See Pat. No. 759.]

A.D. 1765, January 23.—N° 822.

SCOTT, John.—Manufacture of glass and iron from the same material or ore.

Both glass and iron are proposed to be made in the same furnace, and at the same time. The stones, commonly called white stones, and those which are attracted by the magnet, are used for furnishing both iron and glass: those which are not so attracted produce glass only.

[Printed, 3*d.*]

A.D. 1766, June 17.—N° 851.

CRANAGE, Thomas and George.—Making pig iron malleable in a reverberatory or air furnace with raw pit coal only.

" The pig iron is put into a reverberatory or air furnace, built " of proper construction, and, without the addition of any thing " more than common raw pit-coal, is converted into good malleable " iron, and being taken red hot from the reverberatory furnace to " the forge hammer, is drawn into bars of various shapes and " sizes, according to the will of the workman."

[Printed, *3d.*]

A.D. 1771, May 2.—N° 988.

COCKSHUTT, John.—" Making malleable iron directly from " the ore in a finery or bloomery," and " refining pig iron " with charcoal into wrought iron," and " a new finery or " bloomery."

A common finery is filled with raw coals, or coke, or cinders, without ore, and well kindled with a blast. Then a mixture of iron ore (calcined if requisite) and pulverized raw coal or coke is introduced into the finery, with a proper supply of fuel and blast, until the ore melts. The cinder is drawn off " as it grows redundant." When the finery is full of iron, it will have been made malleable (if " right managed "), and the loup or bloom may be hammered and shingled in the usual way, being cut into parts if the bloom be found too large to work in the mass. Pig iron is made into wrought iron by heating sufficient for a bloom or loup in an air furnace, or with bellows. The heated metal is then put into a finery or bloomery, and melted with charcoal until it comes to nature, when it is sunk into a bloom and another charge is supplied. The finery is made of metal plates, open on two or more sides, so that men may work at least on two sides. " Instead of having only one tuiron " for the blast, there are " several tuirons, so as to " direct the wind from the bellows to operate upon the iron in " every part of the fire." The number of tuirons is regulated according to the nature of the iron. " This new finery, and " new method of working, requiring a greater supply of wind " than the common way," an air reservoir with valves is constructed to regulate the blast, the supply being provided by the requisite number of bellows.

[Printed, 3*d.*]

A.D. 1771, December 20.—N° 1000.

GOODYER, JAMES.—" Making steel directly from pig or cast " iron."

" Place the pig or cast iron in the fire as when you intend to " make bar iron, but the blast of the bellows must not be so " strong. When some of the iron is sunk in the fire you must " work from the bottom as when you make iron, but keep melt- " ing iron as at first. When there is a sufficient quantity to make " a loup let the whole sink to the bottom," when it may be fused and shingled, and drawn as common iron. " The fire must be " kept as free from cinder as possible. The addition of common " salt and other saline substances," and animal or charcoal dust, improves the steel. " The finest steel, after it is made as above, " may be converted in the same manner as common steel is made " from bar iron."

[Printed, 3*d.* See No. 505.]

A.D. 1773, April 21.—N° 1041.

BARBER, JOHN.—A machine and apparatus " which, by fire, " water, air, and steam, will purify fossil coal, extract metals " from their ores, and collect their ores, and collect their particles " when volatilised by heat."

The specification and drawing are very curious. A blowing cylinder is first described, worked by water power. The air is admitted, both above and below the piston, by valves, and the blast is blown into a furnace at the up and down stroke. The furnace is covered at the top with a large oblong boiler (which is to contain water or urine, or water impregnated with volatile alkali or other suitable matter). The steam from the boiler (under which the flame and heated gases are conducted by flues to a tower or chimney) is conveyed by steam pipes, through proper adjutages, with great velocity into the furnace, at stated heights above the air blast.

The furnace being fed with air and fuel from above, the blast and steam rush in and rend the ignited matter, driving the gases and volatile matters up and along the flues under the boiler to the chimney; here they are forced through a cistern of cold water by an exhauster or kind of air pump, worked by a curious windmill fixed on the chimney; and so the smoke and all rarefied matter are condensed and recovered.

[Printed, 6*d.*]

A.D. 1773, October 30.—N° 1054.

JESSON, RICHARD, and WRIGHT, JOHN. — Making malleable iron from pig metal, with raw coals or cokes, without granulations or admixtures.

Pig iron, or scull or cinder iron, is melted in a finery with a blast, and with raw coal only. The metal, when heated and prepared, is taken out in lumps while hot, and beaten into plates under a flat stamp or hammer. When cold it is broken small, and well washed by hand or in a rolling barrel.

The broken metal is then melted in a common air furnace or in closed pots, and afterwards "beaten into bars from a chaffery in the common way." If the metal be red short or cold short, it is mixed in the pots with the proper quantity of scrap or nutt iron.

[Printed, 3*d.* See 759, 794.]

A.D. 1776, October 31.—N° 1136.

KER, CHAPMAN, and IRELAND.—Hardening and purifying iron.

The iron is put into a cementing furnace, made carefully air-tight, with wood charcoal, vegetable salts, and oils in various proportions, according as the iron is more or less impregnated with sulphur, and the flexibility and hardness required.

[Printed, 3*d.* See 505, 759, 1000.]

A.D. 1783, January 17.—N° 1351.

CORT, HENRY.—"Peculiar method and process of preparing, "welding, and working various sorts of iron, and of reducing the "same into uses by machinery, a furnace and other apparatus "adapted and applied to the same purpose."

This is the first of Mr. Cort's Patents comprising his process of fagoting bar iron, and of welding by rolling. His second, dated Feb. 13, 1784 (No. 1420), a year later, comprises his process of puddling. "For large uses," or "long pieces of iron of unvarying diameter," the fagot is made by taking a broad flat bar for the base, and laying upon it square bars until the fagot is square. "When the use is of considerable length, " and tapering, a faggot of tapering bars is to be welded, care " being taken the upper bars shall cover the joints of the lower " series." For square uses he employs flat hammer and anvil; for round he employs an anvil, and sometimes a hammer with a semicircular groove. " The fire in the balling furnace is better " suited, from its regularity and penetrating quality, to give the " iron a perfect welding heat throughout its whole mass, without " burning in any part, than any fire blown by a blast." By passing a bundle of fagoted iron when at a welding heat through rollers, "all the earthy particles are pressed out," and the iron " is compressed into a fibrous and tough state." "A bar of " the worst ordinary iron being passed through, becomes " instantly of good quality," and "two or more such bars, or " any pieces of impure iron, heated in the same manner, and " passed through the rollers together, become at once welded " into one solid body, and meliorated into good tough iron, " without being cleansed in the scowering barrel, or otherwise."

Iron plates may be formed by rolling in like manner. The requisite shape may be given to the bars by shaping grooves in the under roller and collars on the upper roller. With powerful mills and large rollers "very great sized iron may be " welded in this manner, as well as under the hammer, the heat being the same in both cases; which process," says Mr. Cort, "is " my own invention, and put in use by me only." Cast-iron scull and scraps after being heated in the balling furnace, and drawn down under the forge hammer, are reheated, and rolled. He describes the gist of his invention as consisting "in taking a " welding heat on several faggots of iron in the same furnace at one time, and drawing the same into uses, either singly or by " welding two or more together by the operations described, " either under the forge hammer, or through the mill rollers, " as may best suit the use intended."

[Printed, 4*d*. Referred to Rep. Arts. vol. 3, p. 239. See Pat. No. 505 (Payne).]

A.D. 1783, March 22.—N° 1360.

MATTHEWS, George.—Making cast-iron [articles] malleable.

The articles are to be cast in the ordinary way and then put in close ovens, cover them with charcoal, excluding air, and let them burn until the charcoal is burned out, when the cast iron will, it is said, have been converted into malleable iron.

[Printed, 6*d*.]

A.D. 1783, May 7.—N° 1370.

ONIONS, Peter.—" Working and refining cast or pig iron, and " converting the same from a fluid state into wrought or bar " iron."

Two furnaces are used, a common smelting furnace and another furnace of stone and brick, " bound with ironwork and well annealed," into which the fluid iron or metal is received from the smelting furnace. " A quantity or stream of cold water is " run or put into the cistern or trough under the ash-grate." The furnace is then charged with fuel and closed up, and the doors luted with sand. The blast is then admitted below the grate, and when the furnace is sufficiently heated the liquid iron metal is taken from the smelting furnace in ladles, and introduced through an aperture, which is then closed. The blast and fire are then used " until the metal becomes less fluid and thickens into a kind of " paste, which the workman by opening the door turns and stirs " with a bar or other iron instrument, and then closes the aper- " ture again, and must apply the blast and fire until there is a " ferment in the metal." If no ferment ensues, a blast of cold air is to be blown upon the metal from an extra pipe. " As the work- " man stirs the metal" the scoria will separate, " and the particles " of iron will adhere," these the workman " must collect or gather " into a mass or lump." This is to be reheated to a white heat, and then taken to the forge hammer and forged into malleable iron. Instead of running fluid metal into the furnace, pig iron may be placed and melted there, and operated upon as above described. The forge hammer is connected with an air cylinder whose piston is attached to the helve, and is worked by it. The cylinder is either placed above the helve and acts as a buffer on the compression principle, or is placed below and on the exhaust principle draws down the hammer.

[Printed, 7*d*. See Patent 780.]

A.D. 1783, November 14.—N° 1396.

JESSON, Richard.—Making bar iron from pig iron, scull or cinder iron, with raw coals or cokes only.

The pig iron is heated in a finery with coal or coke, when taken out in lumps it is beaten flat or into any required shape by hammers or stampers. The plates are piled or other shapes put singly into a small air furnace heated with raw pit-coal. It is there heated, and then forged under the hammer into bars. The pieces broken off under the hammer may be melted in pots with scraps into malleable iron.

[Printed, 3*d.*]

A.D. 1784, February 13.—N° 1420.

CORT, Henry.—" Shingling, welding, and manufacturing iron " and steel into barrs, plates, rods, and otherwise, of purer quality " in larger quantities by a more effectual application of fires and " machinery, and with greater yield than any method before " attained or put in practice."

The patentee uses a reverberatory furnace heated by coal, having a concave bottom, into which the fluid metal is run from the furnace, or pig iron is put in and melted.

When the workman discovers, by looking through a hole, that the metal is sufficiently melted, he opens an aperture, by preference, in the bottom of the door, and works and stirs up the mass of metal with iron bars, "which operation is continued, " as may be requisite, during the remainder of the process." An ebullition of the metal soon takes place, and the stirring with the bar is continued till the metal is " flourished and brought to nature," when it is collected in loops and drawn out of the door. All small pieces that may happen to remain are cleared away. These with scull and parings and nut iron may be thrown into the furnace and worked up with the iron while it is being brought to nature. The iron so prepared may be stamped into plates, broken, piled, and worked in an air furnace, in pots, or without. " But the method invented by me is to continue the loops in the " same," "or reheat them " in another air furnace to a welding heat, and then shingle them into half blooms or slabs. These may be heated in the chaffery, " but my new invention is to put them " again in the same or another air furnace " from which the ball blooms or slabs are taken, and either drawn down under the hammer or rolled in through grooved rollers at a welding heat. Iron and steel so prepared is of good quality, whether the blistered steel be made from fagoted iron or from iron made by the above process "the whole method" is "completed without using finery, " charcoal, cokes, chaffery, or hollow fire without requiring any " blast" or " the use of fluxes."

[Printed, 3*d*. Referred to in Rep. Arts., vol. 3, p. 361. See Pat. Nos. 780, 1370.]

A.D. 1787, June 5.—N° 1608.

PURNELL, WILLIAM.—Preparing, shingling, & welding iron with pit coal from the ore and from pig iron.

The metal is melted in an air or reverberatory furnace, which when the charge is melted is allowed to cool. The loops beaten flat and then forced between rollers. The furnace is then reheated, and the process repeated.

[Printed, 3*d*. Referred to in Rep. Arts, vol. 4, p. 233.]

A.D. 1788, March 4.—N° 1642.

GARDNER, ROBERT.—Manufacturing iron and other metals by a progressively multiplying air furnace.

A series of compartments connected by flues form the multiplying furnace, and the flame and heat pass from one to the other. Each has a separate door, the further compartment being less hot than the more near; the first may be at a welding, the 2nd at a red heat, and the third at a less heat, or, if required, may be raised to a greater heat by adding another and separate fire communicating with the common flue. The waste of putting cold iron into the melting furnace is avoided, as it may be heated by the waste heat in the extra compartments ready for use.

Cast-iron floors for the furnaces save the wear of the old sand floors. Steam boilers may be heated by passing the waste flame and heat from the furnaces round, under, or through them.

[Printed, 3*d*. Referred to in Rep. Arts, vol. 7, p. 361. See Pat. No. 505.]

A.D. 1791, April 18.—N° 1869.

LUCAS, SAMUEL.—" Bringing iron ore and also calx of iron " into a metallic state without first rendering either of them " fluid."

Rich ores, such as Cumberland or Lancashire, are to be put in small pieces in a melting-pot with carbonaceous matter, charcoal, horn, or bone dust, or other cementing substances, which may be mixed in almost any proportions, or in layers. Proportions of four bushels of cementing substance to a ton of ore answer beneficially. The melting-pots are to be made air-tight, and their contents melted in a furnace. The result will be metallic substance mixed with earth, and the greatest part of the metal will be "steel, "and sufficiently converted for making into cast steel, and may be "run into ingots."

[Printed, 3*d.*]

A.D. 1792, June 19.—N° 1891.

FULLARTON, William.—Separating iron from ores, smelting it into pig iron, and reducing it to malleable iron. The ore is calcined, and then crushed, ground, or pulverized very small, being sifted, if necessary. All earthy and other impurities are to be removed, as far as possible, by "washing, levigating, triturating, "winnowing, and by the application of magnetic attraction." The purified materials are to be put in a furnace, which acts as a large crucible, the cast iron not being run from it, but remaining as "a loop or regulus" at the bottom, and on finishing "one "melting, the furnace may be charged again."

[Printed, 3*d.* Referred to in Rep. Arts, vol. 1, p. 297.]

A.D. 1792, October 13.—N° 1915.

LUCAS, Edward.—"Fusing ores, metals, and calx of metals." The metal is to be well freed from sulphur and arsenic, and melted in pots in a furnace, a hole being left in the pots, and an opening in the furnace, to allow the metal to be tapped and the pots to be recharged.

[Printed, 3*d.* Referred to in Rep. Arts, vol. 8, p. 221.]

A.D. 1792, December 22.—N° 1928.

BARBER, John.—"Smelting and purifying fossil coal, iron- "stone, iron ore, and other metallic ores, and the calx thereof, "by steam, air, and fire, and impregnating the same, and the "matrix thereof, with inflammable air, producing thereby a tough "metal."

A.D. 1804, May 30.—N° 2767.

LUCAS, SAMUEL.—Separating impurities from cast iron without fusing it, and rendering the same malleable, and "improving "articles made of cast iron." The cast iron being made in a suitable form, or cast in the shape of various articles, is put in a steel converting or other proper furnace, together with "a suitable "quantity of ironstone, ore, or some of the metallic oxides, lime, "or any combination of these," being pulverized, or with other substances capable of "combining with or absorbing the carbon "of the crude iron." An intense degree of heat is to be applied, and the iron may be made partially or wholly malleable, as required. "If perfectly malleable, one half to two thirds in weight of ironstone will be necessary. The process will be completed in five or six days and nights. The materials should be placed in layers, and, to prevent the iron ore from adhering to the iron, a layer of sand should be used. The same process may be observed, with suitable proportions and degree of heat, for improving cast-iron articles.

[Printed, 8*d*. Referred to in Rep. Arts, vol. 7, (*second series*), p. 256. Engin. and Mech. Ency., vol. 1, p. 783. See 2447.]

A.D. 1804, June 23.—N° 2775.

MARTIN, EDWARD. — "Making of pig and cast iron" from "ironstone, iron mine, and iron ore," and "refining of pig iron," and making such pig iron "into wrought or bar iron by using raw "stone, coal, and culm, to be worked and made by blast."

The process consists in a gradually increasing introduction of charge and blast. The fire is well lighted in the hearth at first with free burning wood. Raw stone coal, broken to the size of a hen's egg, is then fed in until the hearth is full of vivid fire. The furnace is then to be charged with raw stone coal, free from dust, and ironstone in the usual way. The blast is to be introduced in a gentle manner for the first twelve hours, and afterwards gradually increased.

[Printed, 8*d*. Referred to in Rep. Arts (*second series*), vol. 6, p. 161; also in the trial, Crane *v*. Price, Webster, P.C., 391. See Patents, No. 5701 (*Neilson*) and No. 7196 (*Cranes*).]

A.D. 1805, November 7.—N. 2888.

HARTOP, John.—"Method of preparing malleable iron, &c." The invention consists in the use of a kind of squeezer worked by a cam instead of a forge hammer or rollers.

[Printed, 5*d.*]

A.D. 1808, January 23.—N° 3097.

WILKINSON, John.—Making "pig or cast metal from the ore, " which, when manufactured into bar iron, will be found equal in " quality to any that is imported from Russia or Sweden." The invention consists "in making use of manganese or ores contain- " ing manganese, in addition to ironstone and other materials now " used in making iron, and in certain proportions, to be varied by " by the nature of such ironstone and other materials."

[Printed, 3*d.* See Repertory of Arts, vol. 12 (*second series*), p. 347. See Patent, 2663.]

A.D. 1808, July 5.—N° 3149.

PROCTOR, William.—Melting and using "malleable wrought iron or steel." The invention consists in the use of a melting pot, having "the sides of it of one or more separate pieces, sheets, " or tubes of clay luted together," and "which pot shall contain " one or more tubes of clay, so as to enable the fire or fuel to be " applied in the centre or interior as well as surrounding the exter- " nal surface of the pot;" or by using more common pots than " one, so as to conjoin, mix, or cast the metal into one mass or " mould."

[Printed, 3*d.*]

A.D. 1809, January 28.—N° 3197.

ECKHARDT, Anthony George.—"Casting metallic and other bodies, &c." The moulds for casting are set upright, and made to revolve on pivots or spindles. When the metal is poured in, the mould is made to revolve, and the centrifugal force causes the metal to fill up all parts of the mould.

[Printed, 6*d.*]

A.D. 1810, April 6.—N° 3326.

FUSSELL, James.—"Making and working forge and other bellows." The bellows are made of wood or iron and leather, and differ but slightly from smiths' forge bellows of the ordinary construction.

[Printed, 3*d.*]

A.D. 1812, May 26.—N° 3569.

DIMMACK, Jeremiah.—"Manufacturing iron in its difficult "stages or forms of blooms, slabs, piles, bars," &c., "or other malleable iron from pigs or plate iron in a puddling, balling, broom, "mill, sheet iron furnace, or any other air furnace," &c. "Take "any furnace of the common construction," but the grates must not be large, and "less at one end than the other." "Level with "and immediately above the top of the grate," introduce an iron blast pipe, with stopcock to regulate and shut off the blast, and put dampers in the chimney.

[Printed, 3*d.*]

A.D. 1812, October 31.—N° 3612.

SHEFFIELD, William.—"Apparatus and furnaces for separating metallic and other substances from their ores." Furnaces of a peculiar construction are described specially applicable to the manufacture of zinc, having apparatus for condensing the metallic fumes.

[Printed, 9*d.* See Engineers' and Mechanics' Encyclopædia, vol. 1, p. 576.]

A.D. 1814, July 26.—N° 3825.

HILL, Anthony.—"Improvements in the smelting and working of iron." The improvements consist in working up slag or cinder refuse into bar iron, alone or mixed with iron ore, and in applying lime subsequently to the operations of the blast furnace to cure "cold short," and in using in the process of smelting a mixture of lime and mine rubbish, in proportions by preference of six parts of the former to five of the latter. When the slag refuse or rubbish contains about 50 p. c. of iron, the charge is made to consist of about 450 lbs. of coke, 300 to 420 lbs. of slags or cinders, 70 to 95 lbs. of raw mine rubbish, 180 to 240 lbs. of limestone, or 110 to 145 lbs. of lime. These proportions will be varied according to the quality of the iron and other circumstances. The crude iron obtained from this slag and refuse is drawn off, and, either alone or mixed with other iron or refined metal obtained from slag or from iron ore, is worked up by the ordinary processes into malleable iron. Limestone or lime, or substances consisting chiefly of lime, are added to the iron at any time subsequent to its reduction in the furnace, and before it is brought to nature, to cure the defect of cold short. Quicklime is to be used by preference in the refinery or puddling furnace. The properties recommended are, in the refinery furnace $\frac{1}{40}$th to $\frac{1}{60}$th part of lime by weight to one of crude iron. Half the lime to be applied at first, and the rest added gradually. In the puddling furnace $\frac{1}{80}$th to $\frac{1}{100}$th of lime by weight to one part of iron. The lime being slaked or wet is applied during the operation of "drying the iron," and well mixed with the iron in puddling.

[Printed, 4*d*. See Webster's Reports of Patent Cases, vol. 1, p. 225; and Repertory of Arts, vol. 27 (*second series*), p. 1, vol. 20, p. 382; vol. 33, p. 133. This Patent was the subject of the trial of Hill v. Thompson and Forman, and was finally held to be bad, for "want of originality in that claimed by the patentees as new," per Dallas, J. See Patents, Nos. 553, 759, 2447, 2767.]

A.D. 1815, July 27.—N° 3944.

MUSHET, David. — Making or manufacturing iron. The metallic contents of refuse, such as slag, scoria, cinder, scales, &c., are recovered and made available for producing "finers' "iron or metal," in a furnace called "a smelting refinery," by "making use of the superfluous carbon" in pig-iron, which is to be melted with the refuse in the following proportions:—300 or 400 lbs. of coke, 600 lbs. of pig-iron (broken up), 180 to 240 lbs. of refuse, and 150 lbs. of limestone, or by preference 40 to 120 lbs. of burnt lime. When the charge is melted the metal sinks to the bottom, and should be kept carefully covered with the melted scoria; no part is to be run off till the furnace is tapped. If, after the first or second tapping, the metal is not sufficiently decarbonated, or "not high enough blown," the proportion of coke is reduced, or that of refuse increased.

2nd. Instead of "refuse," iron ores may be reduced in a similar manner, by mixing them with pig-iron, the ores being thus used for decarbonating the pig-iron either in their raw state or calcined.

3rd. Instead of the above charge, pig-iron may be omitted, and

350 to 450 lbs. of coke or other fuel, 300 to 350 lbs. of refuse, and 100 to 120 lbs. of burnt lime, or 140 to 170 lbs. of limestone, melted together, will produce finers' metal. The proportion of lime should be with mill scale one sixth, mill or balling furnace slag one third, puddling and finery slag one fourth of their respective weights of burnt lime.

4th. To produce metal from iron ore, 300 to 400 lbs. of coke, 300 to 350 lbs. of iron ore (broken small), and as much lime as would flux the ironstone in an ordinary furnace, are used.

5th. With proper proportions of flux, refuse may be used either with ironstone or iron ore, care being always taken to have a sufficient depth of scoria to protect the metal. "By having a "hearth of sufficient depth below the twyre, part of the scoria may "be run off, and a greater quantity of metal be obtained at one "tapping."

6th. If the materials of the charge are sufficiently fusible the quantity of coke or other fuel may be diminished, or the amount of refuse increased, till "the proper degree of decarbonation" is obtained. Waste is thus lessened, since "the higher the iron "is refined or blown, the less is the loss or waste in the subsequent "manipulations of the forge."

7th. The metal may be kept protected by a sufficient depth of scoria "by drawing off the metal from below," instead of "allow-"ing it to flow off above," thereby requiring less blast.

The furnace recommended for the smelting refinery is similar to a common blast furnace, but smaller, with a square or cylindric hearth, having a height of about twenty to thirty feet, six to eight feet in diameter at the boshes, two to three feet diameter at the top; the hearth being five or six feet high, and two to four feet in diameter.

[Printed, 4*d*. See Repertory of Arts, vol. 29 (*second series*), p. 207. See No. 2825, and Patents cited in note.]

A.D. 1817, August 5.—N° 4151.

HILL, ANTHONY.—"Improvements in the working of iron." These consist "in causing crude iron while in a fluid state, how-"soever and from whatever substance such fluid crude iron may "have been obtained, to be exposed to and conveyed along with "a strong current of condensed air or blast in such manner that it "may be thereby minutely divided and dispersed, and expeditiously

" blown and acted upon by the air." The patentee describes an arrangement of apparatus by which this object can be effected. A cullender of cast or wrought iron shaped like a bucket, being about eighteen inches in diameter at the top, and ten inches at the bottom, is supported in a case on the top of a wrought-iron tube about thirteen inches in diameter, and eight feet long, called the "discharge tube," which is sunk into a well surrounded with water to keep it cool. At the top of the tube just beneath the cullender are apertures for the admission of a blast. The operation is performed as follows:—The molten iron is poured into the cullender and falls through the holes into the discharge tube. At the same time a strong blast is injected into the tube in and among the divided particles of iron, which are thus subjected to its action during their descent into the well. The iron is collected at the bottom of the well, and at the end of the operation the water is discharged from the well, and the iron then "must be made into bar iron by puddling, reheating, and " rolling, or by any other known means."

[Printed, 9*d*. See Engineers' and Mechanics' Encyclopædia, vol. 1, p. 757. See Nos. 759, 794.]

A.D. 1818, April 18.—Nº 4248.

CRAWSHAY, William, and MUSHET, David.—Making " bar or other iron from certain refuse slags or cinders produced in " smelting of copper ores, and in the manufacturing of copper." The slags or refuse from copper ores are known to contain iron in considerable quantities, some more and some less mixed with copper. The slags are mixed with ironstone, or substances containing iron in greater or less proportions, according to the greater or less amount of copper they contain, and smelted in the blast furnace with limestone in the usual way, and worked up by the ordinary processes. The slags should be broken small before being introduced into the blast furnace, or be granulated by melting them and running them into water. Larger quantities of limestone are required than for smelting iron, $\frac{3}{8}$ to $\frac{5}{8}$ by weight, of the slag employed are proportions recommended.

[Printed, 3*d*. See Repertory of Arts, vol. 38 (*second series*), p. 18.]

A.D. 1819, May 15.—Nº 4371.

HOLLINGRAKE, James.—" Casting metallic substances into " various forms and shapes with improved closeness and soundness "in texture." The metal is cast in a suitable mould, and great pressure applied by moveable piston or plugs arranged in any convenient manner, to insure the molten particles being compressed into close contact,

[Printed, 3*d*. See Repertory of Arts, vol. 41 (*second series*) p. 162. See No. 505.]

A.D. 1819, June 22.—N° 4382.

BEDFORD, STEPHEN.—"Preparation of iron and other metals "for various purposes," also "converting British iron into steel." Vitrified iron, slag cinders, and the refuse of iron and other metals, are placed in alternate layers with their respective metallic ores, and covered with the said refuse in an air furnace and melted. The result is an improved quality of metal, and the time necessary for the operation varies according to the nature and quality of the metals, and may be from four to eight days.

[Printed, 3*d*. See Repertory of Arts, vol. 38 (*second series*), p. 138. See No. 3944.]

A.D. 1819, September 20.—N° 4397.

THOMPSON, JOHN. — Extracting iron from ore. The iron ore or stone, raw, or by preference calcined, is to be pulverized small, as about the size of a hazel nut. It may then be washed, and the metallic separated as far as possible from the earthy particles. It is to be afterwards mixed with lime "unburnt or slaked; "of unburnt about one fourth, & of slaked about one sixth part in "weight to one of the iron ore. The use of the black oxide of "manganese is strongly recommended, one twentieth or one "twenty-fifth part in weight of oxide of manganese to one part of "iron ore or ore and lime. This mixture is to be placed in an air "or puddling furnace, in alternate layers with coke or charcoal by "preference, a twentieth of mixture to one of charcoal or coke, or "other substance containing carbon. The charge is then to be "melted & stirred while melting. If the iron is to be cast into "any shapes it must be tapped at the bottom & run out; if it is "to be puddled the furnace must be tapped at the top & the "scoriæ & slag drawn off. The pulverized ore & lime may be "used in the form of cakes consolidated by mixing with water. "The above proportions may be varied, as the invention consists

" in the above processes, wherein the use of the blast & melting " furnace is avoided, and fuel is thereby saved."

[Printed, 3d. See Repertory of Arts, vol. 1 (*second series*), p. 267. See Nos. 2363 and 3097.]

A.D. 1820, October 23.—N° 4504.

TAYLOR, William.—" Improved furnace for smelting iron " and other ores."

The invention consists in the use of several tuyer holes, at various heights and in different sides of the furnace, for the admission of the blast, to effect its being distributed equally, the lower tuyer holes being, by preference, about twenty-four inches from the bottom of the hearth.

[Printed, 5d. See London Journal (*Newton's*), vol. 2, p. 137. See Nos. 988 and 2688.]

A.D. 1820, December 14.—N° 4518.

VAUGHAN, George.—" A blowing machine" for " supplying " blast."

The invention consists in an apparatus formed of plates of metal or wood, for supplying a blast, which it would be tedious to describe without the drawings annexed to the Specification.

[Printed, 6d. See London Journal (*Newton's*), vol. 2, p. 261.]

A.D. 1821, February 20.—N° 4538.

FOSTER, James. — " Improvements in the manufacture of " wrought or malleable iron."

These consist in enclosing a bar of iron, of any suitable size, in several layers of pieces of iron of suitable thickness, the layers being so placed as to break joint. The whole is then bound together in a fagot, and welded, hammered, or rolled in the ordinary way.

[Printed, 5d. See London Journal (*Newton's*), vol. 3, p. 329.]

A.D. 1822, January 9.—N° 4634.

HARFORD, Richard Summers. — " An improvement in " pudling."

The improvement consists in using a layer of charcoal or charred carbonaceous matter, powdered or otherwise, to " protect the cast- " iron bottoms or floors of pudling furnaces " from the effects of the intense heat, and substituting charcoal for the substances usually employed, such as scoria or sand, which impart injurious qualities to the iron.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 4, p. 8.]

A.D. 1822, March 2.—N° 4655.

THOMPSON, JOHN.—Forming and preparing steel for carriage springs.

The invention consists in a method of preparing steel bars for coach springs by rolling instead of hammering.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 4, p. 181.]

A.D. 1822, March 21.—N° 4663.

HARFORD, RICHARD SUMMERS. — "An improvement in the "heating processes in the manufacture" of malleable "iron." This improvement "consists entirely" in covering the cast-iron bottoms of balling, heating, or annealing furnaces with charcoal of wood or other carbonaceous matter, and substituting such charcoal for earthen and siliceous bottoms. The Patent does "not "extend to pudling furnaces."

[Printed, 3*d*. See London Journal (*Newton's*), vol. 4, p. 284. See No. 4634.]

A.D. 1822, April 16.—N° 4667.

DANIELL, WILLIAM.—Rolling iron. The invention consists in improvements in the process of rolling iron when manufactured into bars for making the plates.

[Printed, 3*d*. See Repertory of Arts, vol. 43 (*second series*), p. 73.]

A.D. 1822, August 20.—N° 4697.

MUSHET, DAVID.—Making iron from slags or cinders. The slags or cinders are reduced to "a small size by shotting" or other suitable means. They are then mixed with flour lime in the proportions found suitable in practice, one fifth or one sixth "being "sufficient for those containing the greatest quantity of "siliceous or other ingredient." The mixture is moistened to bring the lime in close contact with the ground slag, and charged on the blast furnace. The iron produced works more grey, and is more fusible in the refinery furnace than common qualities of iron, and requires a longer time to refine.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 5, p. 294.]

A.D. 1822, October 18.—N° 4713.

JONES, William. — "Improvements in the manufacturing of "iron." The invention consists in charging the puddling furnace with refined metal, pig or crude iron in a heated state, instead of putting the charge in cold. The heating operation may be performed either by the heat of the puddling furnace or in a separate furnace.

[Printed, 3*d*. See Repertory of Arts (*second series*), vol. 45, p. 336. See No. 1642.]

A.D. 1822, December 20.—N° 4743.

PASS, William.—"Calcining and smelting ores." The invention consists, 1st, in applying a feeding hopper to the calcining or smelting furnace, so as to supply fuel continuously and gradually.

2nd. In the use of an additional fireplace over which the fumes from the furnace must pass, and the volatilized matters extracted from the ores "will be metallized" and collected in a receiver or a flue.

3rd. In applying centrifugal bellows "at the farther end of the flue" to create a "sufficient draft."

[Printed, 5 . See London Journal (*Newton's*), vol. 8, p. 113.]

A.D. 1823, April 12.—N° 4774.

ACRAMAN, Daniel Wade, and PIPER, William.—"Improvements in the preparation of iron."

These are stated to consist in preparing bars of wrought iron in a peculiar shape, so that links of chains may be made having he stay in one piece with the link, or fastened by a groove with ribs formed in the bar.

[Printed, 5*d*. See London Journal (*Newton's*), vol. 6, p. 19.]

A.D. 1823, November 13.—N° 4865.

STEIN, Robert.—"Improved blast furnace."

No Specification of this invention was enrolled.

A.D. 1824, February 28.—N° 4909.

CHRISTIE, John, and HARPER, Thomas.—" Combining and " applying certain kinds of fuel."

The Patent is for the use of bituminous coal in such proportions as to enable anthracite or stone coal to be employed, without producing the nuisance of smoke. The proportions vary with the size and shape of the grate or furnace—onefifth to one third parts of bituminous coal, to one of stone coal, may be used beneficially. The stone coal may be used in its usual form, or mixed with one half small or culm.

[Printed, 3*d*. See Webster's Patent Cases, vol. 1, p. 377; London Journal (*Newton's*), vol. 10, p. 122. This Patent was referred to in the trial Crane *v*. Price, Webster's Patent Cases, 377. Compare Nos. 2775, 5244, 7195.]

A.D. 1824, April 7.—N° 4932.

SPENCER, Joseph.—Improvements in furnaces or forges " for the preparation of iron or steel," and for manufacturing nails and other articles.

The Specification describes a circular furnace or forge, four feet in diameter, and three feet high, having a fine cast-iron grating about twenty inches from the bottom. The furnace is specially intended for the manufacture of nails.

[Printed, 2*d*. See Repertory of Arts, vol. 1 (*third series*), p. 137; London Journal (*Newton's*), vol. 9, p. 15; Register of Arts and Sciences, vol. 2, p. 230.]

A.D. 1854, May 15.—N° 4953.

CHURCH, William.—Apparatus for casting iron.

No Specification was enrolled.

A.D. 1824, May 15.—N° 4956.

LUCKCOCK, Joseph.—" An improvement in the manufacture " of iron."

The improvement is stated to be the use of salt in certain quantities, ascertainable by experience, to be mixed with the iron in the state in which it comes from the blast furnace, and worked up with it in the puddling furnace.

[Printed, 3*d*. See Repertory of Arts (*third series*), vol. 5, p. 200; London Journal (*Newton's*), vol. 10, p. 250. Register of Arts and Sciences, vol. 3, p. 340; Engineers' and Mechanics' Encyclopædia, vol. 2, p. 454. See Nos. 505, 1000, 1130.]

A.D. 1824, June 15.—N° 4968.

HOOTON, Richard.—Manufacturing iron.

"My invention consists in rolling iron from any number of "pieces of puddled billets (more than one), which I fasten together "by bands, or otherwise. In witness, &c."

[Printed, 3*d*. See London Journal (*Newton's*), vol. 10, p. 87; Register of Arts and Sciences, vol. 3, p. 141. See Nos. 1351 and 4538.]

A.D. 1824, October 7.—N° 5003.

NEEDHAM, Francis Henry William.—"Improved method "of casting steel." The steel is melted in fixed pots in the shape of troughs or deep dishes, surrounded with fire like gas retorts. They have moveable tops, and tubes fixed in their lower sides, through which the melted steel is run off as required. The pots may contain different qualities of steel, and be acted upon in different degrees by the fire. Large castings may be made of steel so melted, and steel of different qualities be employed in casting the various parts, as required or found expedient in practice.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 10, p. 23; Register of Arts and Sciences, vol. 3, p. 53; Engineers' and Mechanics' Encyclopædia, vol. 1, p. 789. See No. 1915.]

A.D. 1824, November 6.—N° 5031.

WHITE, John, and SOWERBY, Thomas.—"Air furnace for "melting metallic substances." A furnace is described with the aid of drawings, having several "flues or openings" to give to the currents of air different directions through the fuel, as the heat is required to be applied, and so dispensing with the "mechanical "power used for the blast."

[Printed, 6*d*. See Repertory of Arts, vol. 2 (*third series*), p. 288; London Journal (*Newton's*), vol. 10, p. 69; Register of Arts and Sciences, vol. 3, p. 70; Engineers' and Mechanics' Encyclopædia, vol. 1, p. 559.]

A.D. 1824, December 9.—N° 5051.

THOMPSON, John.—Making refined cast steel. The patentee, instead of crucibles, proposes to employ a furnace of peculiar construction, resembling a puddling furnace, in which are placed troughs or vessels in which the metal is melted.

[Printed, 7*d*. See London Journal (*Newton's*), vol. 10, p. 75; Register of Arts and Sciences, vol. 3, p. 38; Engineers' and Mechanics' Encyclopædia, vol. 1, p. 790.]

A.D. 1825, February 26.—N° 5109.

WHITEHOUSE, Cornelius.—"Manufacturing tubes for gas." This was a patent for welding tubes, and the invention was held by the Courts of Law (where it was the subject of long litigation) to consist in welding tubes by circumferential pressure without a mandril.

[Printed, 6*d*. See reports of various trials, Webster's Patent Cases, vol. 1, pp. 455 and 478.]

A.D. 1825, March 5.—N° 5115.

HALLEY, William.—Improved forge and bellows. The forge is intended to be a portable one, adapted for use on board ship. The bellows are square like organ bellows.

[Printed, 1*s*. See Repertory of Arts, vol. 1 (*third series*), p. 118.]

A.D. 1825, May 14.—N° 5173.

MACINTOSH, Charles.—Making steel. Malleable iron is converted into steel by placing it in close fire-resisting vessels, such as crucibles or glass-house pots in a suitable furnace. When the iron in the vessels is at a white heat currents of gases charged with carbon, such as curburetted hydrogen, are introduced into the pots through suitable openings fitted with the necessary tubes and stopcocks. The gas thus brought into contact with the superheated iron will convert it into steel.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 13, p. 133; Register of Arts and Sciences, vol. 4, p. 502; Engineers' and Mechanics' Encyclopædia, vol. 1, p. 787.]

A.D. 1825, May 14.—N° 5174.

BADAMS, John.—Extracting metals from ores, and purifying metals. No Specification was enrolled.

A.D. 1825, August 18.—N° 5244.

TAYLOR, Philip.—Making iron. The invention consists in injecting carburetted hydrogen gas, pure or combined with other materials, into the blast furnace instead of atmospheric air. Stone coal may be thereby used, when required, instead of bituminous coal and other fuel.

[Printed, 9*d*. See Webster's Patent Cases, vol. 1, p. 577; Repertory of Arts, vol. 3 (*third series*), p. 250; London Journal (*Newton's*), vol. 13, p. 331; and Register of Arts and Sciences, vol. 1 (*new series*), p. 164. See Nos. 1041, 2775, 4909.]

A.D. 1825, October 6.—N° 5259.

MARTINEAU, John, and SMITH, Henry William.—Manufacture of steel. The invention consists in forming a kind of steel, called meteor steel, by alloys of twenty-four parts of zinc, and four parts of nickel, and one of silver.

[Printed, 3*d*. See Repertory of Arts, vol. 3 (*third series*), p. 205; London Journal (*Newton's*), vol. 12, p. 362; Register of Arts and Sciences, vol. 2 (*new series*), p. 75; and Engineers' and Mechanics' Encyclopædia, vol. 1, p. 791.]

A.D. 1825, October 13.—N° 5263.

KIMBALL, Nathaniel.—Converting iron into steel. A certain mixture is to be used instead of charcoal in alternate layers with the iron to be converted by cementation. To make the mixture, take "sal ammonia 1 oz., borax 1 oz., alum 1 oz., fine salt 1 quart;" put them into an iron vessel, stir them, and heat to a red heat. When the mixture ceases to smoke let it cool, and pulverize it to dust. Afterwards take "strong soot 4 quarts, pulverized burnt "leather 2 quarts, burnt horse hoof 2 gills, fine salt 1 pint, vinegar "1 quart, urine 2 quarts;" boil the whole, and evaporate until a powder is left. It is then to be sifted fine, and mixed with the other compound first prepared, and the whole used in layers to convert iron into steel. The above quantities are sufficient for about a hundredweight of iron.

[Printed, 3*d*. See Repertory of Arts, vol. 6 (*third series*), p. 276; and London Journal (*Newton's*), vol. 13, p. 141.]

A.D. 1827, February 20.—N° 5467.

JEFFERIES, William.—"Calcining or roasting and smelting "or extracting metals and semi-metals from various kinds of ores." The ores are pulverized so small as to pass through a sieve of eight or ten holes to the inch. They are then mixed with small or broken coal, and the mixture is put "into an ordinary coke oven," and "coked in the same manner as if coal alone were used." The charge is cooled, withdrawn, and broken up to a size proper for smelting; it is put into the smelting furnace, and the fuel so coked with the metal or semi-metal will be sufficient fuel for smelting, or more must be added, the proportions being ascertained by experience. The coal is by this process coked and the ore roasted by one heat, and combined together in a more perfect operation, saving fuel and labour.

[Printed, 3*d.* See London Journal (*Newton's*), vol. 1 (*second series*), p. 352; Repertory of Arts, vol. 5 (*third series*), p. 257; Register of Arts and Sciences, vol. 2 (*new series*), p. 66; and Engineers' and Mechanics' Encyclopædia, vol. 1, p. 756.]

A.D. 1827, April 18.—N° 5492.

SOMERS, Benjamin.—"Furnaces for smelting different kinds "of metal ores and slaggs. The furnace is formed of the slag of "ore with an iron pan at the bottom, and two holes in the same "for tapping the metal. The space round the furnace is filled up "with slag beat very hard," and "the sides of the pan are filled up "level with slag," and also the pan itself (which is slanted) in a similar manner. "A fire is then made of coke in the centre of the "furnace, and the slag laid round in a circle, as it burns away more "slag is supplied, until, by incrustation," it forms the furnace, which is to be worked by blast through an aperture at the back.

[Printed, 3*d.* See London Journal (*Newton's*), vol. 2 (*second series*), p. 24; and Register of Arts and Sciences, vol. 3 (*new series*), p. 165.]

A.D. 1828, January 2.—N° 5596.

BOTFIELD, Thomas.—"Improvements in making iron, &c." "The principle is for causing or obtaining a blast of atmospheric "air sufficient to smelt" pig iron "from ironstone." "This blast "is produced by means of rarified air, gas flame, or heated air "from an oven or fireplace, and is to be applied in or to a blast "furnace, cupola, or air furnace." This is to be effected by means of tall chimnies attached to the blast furnace by flues in connexion with or without the common blast. The heated air, gases, and flame being driven out of the heating oven into the furnace. The Patent also claims the mixing of salt or other substance containing soda in the blast furnace.

[Printed, 3*d.* See Webster's Patent Cases, vol. 1, p. 274; Repertory of Arts, vol. 18 (*new series*), p. 179; and London Journal (*Newton's*), vol. 7 (*second series*), p. 65. See Nos. 505, 759, 1041.]

A.D. 1828, February 21.—N° 5621.

BRUNTON, William.—"Furnaces for the calcination, sublima- "tion, or evaporation of ores, metals, and other substances." The furnace is made circular, having the fireplace on one side and the flue on the other, in the ordinary way. The floor or bottom is made circular, higher in the middle than at the edges, and is made to revolve, supported on a shaft or spindle which passes through its centre. It is somewhat less in diameter than the inside of the furnace. The roof of the furnace is a flat arch, and in the middle a hole is left, into which is fixed a hopper over the centre of the revolving bottom. The ore to be calcined is fed to the furnace by the hopper. On the side of the furnace next to the flue, and farthest from the fire, are fixed " a succession of pieces of metal called scrapers," fixed obliquely, so that as the ores fall upon the centre of the revolving bottom they are gradually scraped from the centre towards the circumference as the bottom turns round, and fall through a hole into a tub or receptacle, by which means all the ore is subjected gradually to the action of the fire. The spindle or shaft of the revolving bottom passes up through the centre of the hopper, and has cross bars fixed upon it, which stir up the ores in the feeding hopper. The revolving bottom is driven by any suitable means, and its velocity will depend upon the degree of heat required in the operation. In order to prevent the air from entering between the revolving bottom and the furnace the spindle may work through a hole made air-tight, or an iron ring or hoop, nine inches broad, is fastened to the bottom, and revolves in a trough of sand formed in the brickwork of the furnace. Particulars are given, showing how the bottom is to be made of radiating arms of iron, fastened to the iron spindle, and supporting a layer of brickwork, and how the spindle is supported in cast-iron sockets, &c.

[Printed, 4*d*. See Repertory of Arts, vol. 8 (*third series*), pp. 159, 577; and London Journal (*Newton's*), vol. 3 (*second series*), p. 320.]

A.D. 1828, September 11.—N° 5701.

NEILSON, James Beaumont.—" Improved application of air " to produce heat in fires, forges, and furnaces, where bellows or " other blowing apparatus are required."

The blast may be produced by the ordinary blowing apparatus, but, before conducting it to the furnace, it is heated in a closed " air vessel or receptacle " " to a considerable " temperature." No specific degree is claimed. " A red heat, " or nearly so," will be beneficial, though so high a temperature is not absolutely necessary. The air vessel or receptacle may be of iron or other suitable material, and the size must depend on the blast and heat required. For an ordinary smith's fire, dimensions of "1,200 cubic inches will be proper;" for a cupola fire, of the usual size for cast-iron founders, "10,000 cubic "inches will be of a proper size." For the larger operations, such as those of blast furnaces, larger air vessels are employed. "The "form or shape of the vessel or receptacle is immaterial to the "effect, and may be adapted to the local circumstances or situa-"tion." The air vessel may generally be heated "by a fire "distinct from the fire to be affected by the blast." "The man-"ner of applying the heat to the air vessel is however immaterial "to the effect, if it be kept at a proper temperature."

[Printed, *3d.* See Webster's Patent Cases, vol. 1, p. 273 et seq.; Mecson and, Welsby, vol. 8, p. 806; London Journal (*Newton's*), vol. 7 (*second series*), p. 20 (*conjoined series*), vols. 18, 19, 23; Register of Arts and Sciences, vol. 3, p. 301; and Engineers and Mechanics' Encyclopædia, vol. 1, p. 764. This Patent was the subject of protracted litigation, but was finally established. See supra, No. 5596.]

A.D. 1829, March 30.—N° 5779.

LAMBERT, Josias.—Making iron. The invention consists in the application of two parts salt and one of potash, in the blast, or refinery, or puddling, or balling furnaces. The mixture being applied to iron of inferior quality at a high degree of heat, is stated greatly to improve it.

[Printed, *3d.* See Repertory of Arts, vol. 8 (*third series*), p. 658. See No. 505, also No. 5793 infra.]

A.D. 1830, February 4.—N° 5893.

LAMBERT, Josias.—Making iron. The invention consists in the use of a mixture of salt, potash, and lime, or a mixture of salt saltpetre, and lime, in the smelting, or puddling, or balling processes, in all or any of them. The proportions recommended by preference are two parts salt, one of potash, and two of lime, for the first mixture, to be used when the iron is of red short quality, and for the second mixture, two parts salt, one and a half saltpetre, and two parts lime, to be used when the iron is found to be "cold short." The mixture may be introduced in the furnaces at regular intervals, or combined with every change of materials. The mixtures are used in proportions varying according to the qualities of the iron. The following are recommended:—In the blast furnace 25 lbs. to the ton of iron, in the refinery 20 lbs. to a ton of iron, in puddling 18 lbs. to the ton, in the balling furnace 18 to 30 lbs. per ton of iron.

[Printed, 3*d*. See Repertory of Arts, vol. 9 (*third series*), p. 282; London Journal (*Newton's*), vol. 5 (*second series*), p. 276; Register of Arts and Sciences, vol. 5 (*new series*), p. 2; and Engineers and Mechanics' Encyclopædia, vol. 1, p. 771.]

A.D. 1831, December 22.—N° 6207.

DAWES, John Samuel.—Manufacture of iron. The invention consists in introducing, at the lower part of a blast furnace, charcoal or other fuel mixed with suitable fluxes, during the operation of smelting, in addition to the usual method of charging at the top or tunnel head. This introduction of the charcoal or fuel is effected by means of conical tubes fitted to the top and projecting (at the lower end) a little beyond the mouth of the blast pipes; the fuel and materials being thrown down the pipes are driven into the furnace with the blast.

[Printed, 3*d*. See Repertory of Arts, vol. 14 (*third series*), p. 11; London Journal (*Newton's*), vol. 1 (*conjoined series*), p. 248; and Register of Arts and Sciences, vol. 7 (*new series*), p. 197.]

A. D. 1832, January 17.—N° 6211.

TEAGUE, Moses.—Making and smelting pig iron. The patentee proposed to turn to account the flame and heated gases usually discharged from a furnace or cupola into the open air, by causing them to act upon ores or minerals, and so heating them partially before introducing them into the furnace or cupola, thereby saving time and fuel. This object is to be effected by erecting one or more ovens, stoves, or other buildings near the top or tunnel head of the furnace. In these are deposited the ores or mine to be heated, and the flames or heated gases from the furnace or cupola are directed into them, by employing dampers, flues, or other suitable means. A full description, with Drawings, is given of the furnace and heating ovens of the patentee.

[Printed, 3*d*. See Repertory of Arts, vol. 14 (*third series*), p. 1; London Journal (*Newton's*), vol. 3 (*conjoined series*), p. 26; Mechanics' Magazine, vol. 20, p. 209; Register of Arts and Sciences, vol. 7 (*new series*), p. 169, and Engineers and Mechanics' Encyclopædia, vol. 1, p. 755. See Patent 1642.]

A.D. 1832, September 7.—N° 6299.

HORTON, Daniel, and HORTON, George. — "Improved puddling furnace." The invention consists in applying to the old puddling furnaces certain additions claimed as new, viz. hollow vessels or cases forming the ends and sides of the lower part of the puddling furnace, allowing air or water to circulate in contact with the inside casing of the puddling furnace, the object being to enable a very high degree of heat to be used in the puddling furnace without its being destroyed, the injurious effects being prevented by the circulation of air or water carrying off the superfluous heat. The use of this puddling furnace (which is fully described with Drawings) enables the refining process to be dispensed with. On the bottom and sides of the furnace are strewed slag and cinder to the depth of about an inch or an inch and a half. These are melted, and form a bottom, on which are placed broken pig iron and ¼ by weight of cinder and slag. The whole is then "raised " to a higher degree of temperature than is usual in puddling " refined iron, which will cause the pig iron to boil," "during " which operation the same is to be well stirred" by the puddler " until the malleable iron is disengaged from the cinder." The heat, if necessary, is then to be damped off. The iron is to be balled, and the puddling completed in the ordinary way; and when the balls are withdrawn, the fluid cinder is run out, and a fresh charge is put in. Malleable iron is thus produced direct from the pig.

[Printed, 1*s*. 10*d*. See Repertory of Arts, vol. 15 (*third series*), p. 205; London Journal (*Newton's*), vol. 10 (*conjoined series*), p. 356; and Engineers and Mechanics' Encyclopædia, vol. 1, p. 777.]

A.D. 1832, September 8.—N° 6300.

JONES, George, FOSTER, James, BARKER, John, JONES, John. — Making malleable iron. The patentees claim as their invention taking iron, while in a liquid melted state, from the blast furnace (in ladles or otherwise), introducing it into the puddling furnace, puddling it, and so converting it into malleable iron without remelting.

[Printed, 3*d*. See Repertory of Arts, vol. 15 (*third series*), p. 205; London Journal (*Newton's*), vol. 10 (*conjoined series*), p. 356. See No. 1420.]

A.D. 1833, January 29.—N° 6374.

DAWES, JOHN SAMUEL.—Manufacture of iron. "My improvements consist in producing malleable iron from iron slag or cinders, or other oxides of iron, by mixing with such oxides coal, charcoal, or other substances having greater affinity for oxygen than iron has, and submitting the same to heat in a reverberatory or other furnace, and continuing such process until decomposition be effected. In witness, &c."

[Printed, 3*d*. See London Journal (*Newton's*), vol. 3 (*conjoined series*), p. 149.]

A.D. 1833, January 31.—No. 6379.

GUEST, JOSIAH JOHN.—Reducing iron ore to finers' metal. The invention consists in affixing to the blast furnace an iron shoot or channel, and running the molten metal from the blast furnace direct into the refinery furnace (which is placed near thereto), where the iron is acted upon by a blast in the usual way, and is converted into finers' metal without being remelted.

[Printed. 3*d*. See Repertory of Arts, vol. 16 (*third series*), p. 346; London Journal (*Newton's*), vol. 3 (*conjoined series*), p. 209. See Patents, Nos. 1420, 4713.]

A.D. 1835, May 13.—N° 6837.

SCHAFHAUTL, CHARLES.—Manufacturing malleable iron. The Specification of this Patent appears to have been stolen. From the references given below, it seems that the invention consisted in the use of black oxide of manganese 1¾lbs., common salt, well dried, 3¾lbs. potters' clay (well washed) 10oz. The ingredients are well mixed and ground fine, and fused with about 3¾ cwt. of pig iron in the boiling oven. The colour of the flames will indicate the progress of the fusion. The mixture being by preference introduced in three portions, the result will be good soft iron. To produce a harder iron, three or four shovelfuls of roller refuse and cinder from balling furnace are added, and only half the quantity of manganese employed. Less quantities of manganese, and more of refuse and slag, will produce a harder iron.

[See Repertory of Arts, vol. 4 (*new series*), p. 334; and London Journal (*Newton's*), vol. 7 (*conjoined series*) p. 341.]

A.D. 1835, October 8.—N° 6901.

DEVAUX, Charles Pierre.—Smelting ironstone or iron ore. The improvements relate to apparatus placed between the blowing machine and the furnace, whereby the blast of air is driven among and heated by a fire enclosed in the said apparatus; the compressed blast is thus carried forward, heated, and mixed with gaseous flame, and is blown into the blast furnace, producing a saving and improvement.

The Specification and drawings particularly describe the apparatus and process.

[Printed, 7*d*. See Webster's Patent Cases, vol. 1, p. 275; and Repertory of Arts, vol. 5 (*new series*), p. 272; also Patents, Nos. 1041, 5596, 5701].

A.D. 1835, October 22.—N° 6908.

MUSHET, David.—Manufacturing bar iron or malleable iron. The Specification commences by giving a detailed account of the refinery and puddling processes, and the terms employed therein, and of the different qualities of cast iron. It then proceeds to describe the improvements patented, which consist in mixing finely-powdered iron ores of rich qualities with the iron while being puddled in the puddling furnace. Sometimes powdered charcoal is mixed with the powdered iron ores. The mixture is added in small doses, and promotes the fermentation of the iron, and causes it sooner to be "brought to nature." It also enables crude iron to be used without being refined, and produces a bar of improved quality and greater weight than the old processes. A charge of about 450 pounds of crude pig iron varying in quality from bright grey and mottled to white according to circumstances and the judgment of the manufacturer (No. 2 grey iron foundry metal will produce excellent bar iron) is employed; when it begins to melt, and is fit to be stirred by the puddler, a dose of about two pounds of powdered ore or ore and charcoal is sprinkled on the iron, and well stirred up with it. The doses are gradually repeated as they are absorbed, until about forty pounds of powdered ore (or one eleventh by weight of the charge of crude pig iron) have been sprinkled on the fermenting iron. The puddling process is carried on meanwhile in the usual way. If charcoal is mixed with the powdered ore, it should be wetted. By *this process* about twenty hundredweight of puddled bars are produced from twenty-one and a half hundredweight of crude pig iron of as good quality as would be obtained from ordinary refined metal. If refined metal or "plate" be used instead of crude pig iron, to a charge of 450 pounds about twenty-five pounds of powdered ore should be used, and twenty hundredweight of puddled bars are produced from twenty and three quarters hundredweight of refined metal or plate. Other proportions and particulars are given according to the quality of the materials employed.

[Printed, 6*d*. See Repertory of Arts, vol. 8 (*new series*), p. 91; and London Journal (*Newton's*), vol. 9 (*conjoined series*), p. 164.]

A.D. 1835, December 9.—N° 6948.

DAWES, JOHN SAMUEL.—Manufacture of iron, &c. The improvements "consist in applying to the blast or smelting "furnace, in addition to the atmospheric air, pure hydrogen gas, "or the hydrogen obtained by the decomposition of water." The gas is introduced either mixed with the air, or "by separate tweers." The water is decomposed by passing it "in a state of steam through iron pipes" or other closed vessels "heated to a red heat, containing coke, cinders," or other refuse. The oxygen entering "into other combinations leaves the hydrogen free," and the latter "may be pressed through water or lime water into a regulator," and so "separate carbonic acid," and be forced into the furnace, or other mechanical means may be employed for injecting it. Cyanogen is formed within the furnace, and, in union with potassium, by introducing a pipe near the tweers it is to be drawn off and collected.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 14 (*conjoined series*), p. 161.]

A.D. 1836, June 13.—N° 7117.

SCHAFHAUTL, CHARLES.—"Apparatus for puddling iron." The Specification and drawings describe an apparatus for working the stirring tool, and giving it the necessary longitudinal and transverse motions in the puddling process.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 14 (*conjoined series*), p. 32.]

A.D. 1836, July 4.—N° 7142.

HAWKINS, JOHN ISAAC.—Manufacturing iron and steel. The invention consists in taking iron ore in its roasted state called "burnt mine," and subjecting it to the chemical process of cementation, "according to and in imitation of certain testing "samples, to be obtained as herein-after particularly described." The roasted ore is broken in lumps of three or four pounds weight, and each lump is enveloped as much as practicable in pulverized charcoal, in a close vessel, and subjected to the process of cementation. Seventeen circumstances are minutely described as requiring the attention of the manufacturer. The testing samples are obtained by melting twenty samples, each of about twenty pounds of ore, every lump of ore being well surrounded by charcoal, in twenty different pots, and subjecting each pot to a high degree of heat for a different period of time, the first for eighty hours, the second for seventy-six hours, the third for seventy-two hours, &c. Special and minute directions are given as to the mode of proceeding for obtaining a sample from each pot, and as to the way in which the samples are to be used in guiding the manufacture on a large scale.

[Printed, 4*d*. See Repertory of Arts, vol. 8 (*new series*), p. 226; and London Journal (*Newton's*), vol. 14 (*conjoined series*), p. 222.]

A.D. 1836, September 28.—N° 7194.

HAWKINS, JOHN ISAAC.—"An improvement in the blowing "pipe of blast furnaces and forges." The mouth of the blowing pipe is to be so constructed as to deliver the blast "in thin sheets" (instead of in a dense stream), so that the blast may possess "great surface in proportion to its bulk," and "impart its oxygen "immediately to a large quantity of the ignited fuel," and also avoid the "chilling effect" produced by a thick dense blast. This object is effected in various ways, as by making the mouth of the blowing pipe bell-shaped, and inserting in it a moveable conical piece, whose axis is concentric with that of the blowing pipe. The annular aperture left between the conical piece and the bell mouth delivers the blast in a thin circular sheet, thinner or thicker according to the adjustment of the conical piece. Again, the blowing pipe may terminate in two or more branches, each having a long narrow orifice like a slit. Sometimes five or more mouthpieces with circular orifices are used.

[Printed, 3*d*. See Repertory of Arts, vol. 8 (*new series*), p. 109; and London Journal (*Newton's*), vol. 11 (*conjoined series*), p. 102.]

A.D. 1836, September 28.—N° 7195.

CRANE, George.—"An improvement in the manufacture of "iron." This Patent is for the combined use of the hot blast and anthracite coal in the manufacture of iron. The Specification does not claim any particular mode of user, but describes the ordinary mode found beneficial. It states that the iron produced by the hot blast and anthracite coal will be of improved quality, "resembling iron "obtained by the aid of vegetable charcoal." The blast is recommended to be of about 600° of heat, and the charge is of "3 cwt. "of anthracite coal" to "5 cwt. of calcined argillaceous ironstone "with a proper quantity of flux." The anthracite may be coked, but this is not necessary. In order that the hot blast should act unimpeded, anthracite or stone coal is used of such a size that it will not pass through an inch mesh sieve; but if the blast be of a pressure of two pounds and upwards on the square inch this precaution of only using large pieces is unnecessary. The claim is for "the application of anthracite or stone coal and culm with the "using of hot-air blast in the smelting and manufacture of iron "from ironstone, mine, or ore."

[Printed, 3*d*. Referred to in Webster's Patent Cases, in the trial of Crane *v*. Price, vol. 1, p. 375 et seq.; Manning and Granger, vol. 4, p. 580. See Repertory of Arts, vol. 9, p. 52 (*new series*), also vol. 18; London Journal (*Newton's*), vol. 11 (*conjoined series*), p. 344, and vols. 15, 16, 20; and Mechanics' Magazine, vol. 36, pp. 109 and 494.]

A.D. 1837, January 11.—N° 7272.

ADCOCK, Henry.—Improved furnace. "Instead of employing "artificial blasts," the patentee proposes to employ the natural pressure of the atmosphere, or the difference between the density of heated air in the chimney and that of air at the mouth of the furnace. This is done by making the interior of the furnace "of "the form of an inverted cone, like unto a limekiln." "The "smallest part of the cone, or the bottom of the furnace, is con-"nected by a flue with a chimney. At the bottom of the cone a hollow space or chamber is made for the reception of the melted metal or scoria. The dam and copping hole are made as in ordinary practice.

[Printed, 3*d.*]

A.D. 1837, May 5.—N° 7380.

FREEMAN, Joseph. — Improved rolls for rolling bars, &c. The improvement consists in making provision against the wearing away of the rolls or collars, by so constructing them that "the "working surfaces thereof may with facility be so relatively set up "to each other, as they become worn, that they may continue to "produce bars or rails of unvarying guage." The Specification and drawings show how the rolls may be removed, altered, and readjusted.

[Printed, 1*s.* See Repertory of Arts, vol. 9 (*new series*), p. 90.]

A.D. 1837, October 20.—N° 7448.

DUCLOS, Edward Francis Joseph.—Manufacturing iron. The invention consists in combining with "cast iron and its "scoriæ, while they are in a state of fusion," metallic chlorides (as of manganese and calcium), whose bases combine with the iron and slag, while the chlorine combines with the volatile impurities, such as sulphur, given off by the iron. Both of these combinations are said to produce a beneficial effect upon the iron, and produce an alloy equal to malleable charcoal iron. The Specification and drawings describe a refinery furnace having a crucible. About 30 cwt. of cast iron are introduced into the furnace when it is at a white heat, and immediately afterwards 336 lbs. of dry chloride of manganese, and 6¾ lbs. of bichloride of calcium or "bleaching "powder," are put into the crucible. Over the mixture is put a layer of wood charcoal two or three inches thick, and over that a layer of scoria, of like thickness, mixed with sufficient quicklime to combine with the free silica contained in the scoria. The whole is then melted, and the surface of the metal is again covered with wood charcoal. "The usual tools for working the metal are "then introduced," and during the working portions weighing ten pounds each of the chloride of manganese and bichloride of calcium, are thrown in at intervals. The surface is to be kept covered with charcoal, and in half an hour the refined metal may be run out. It is then puddled, and during that process the chlorides must be added at intervals in proportions of about 1 per cent. of the weight of the metal. The bridge of the puddling furnace is made double, and the space between is filled up with wood charcoal. When the slag has been run out, and the metal brought to nature, in order to free it from all siliceous impurities it is submitted to the action of a charcoal fire.

[Printed, 5*d*. See London Journal (*Newton's*), vol. 12 (*conjoined series*), p. 345.]

A.D. 1837, December 4.—N° 7495.

BOOKER, Thomas William.—" Preparing iron to be coated with tin and other metals." The Specification and drawings describe an improved mode of preparing iron by " pickling " it in diluted acid.

[Printed, 6*d*. See Repertory of Arts, vol. 10 (*new series*), p. 80.]

A.D. 1837, December 9.—N° 7502.

MILLS, Samuel.—" Machinery for rolling metals." The Specification and drawings describe rollers of which parts of the working surfaces are removed, so that the workman can regulate the degree of rolling, and deliver metal of a taper shape.

[Printed, 8*d*. See Repertory of, Arts, vol. 10 (*new series*), p. 96.]

A.D. 1837, December 19.—N° 7518.

CLAY, William Neale.—Manufacture of iron. The invention relates to the working of the rich red iron ores, such as the Lancashire and Cumberland red ores. The ores are broken small to the size of walnuts, and with 100 parts by weight of this broken ore are mixed twenty parts of dry coal ashes, or cinders of coke, or charcoal broken small to pass through a half-inch sieve. This mixture is put in retorts by preference of a D shape seven feet long, eighteen inches high, and two feet wide, made of fire-bricks or iron, or other suitable material. The retorts are by preference fixed in a chamber at the end of a puddling or other furnace, so that the heat of the furnace may be advantageously employed in heating the retorts, or they may be heated in any other convenient manner. One end of each retort is stopped by a door, like a gas retort, so that the charge may, when ready, be withdrawn, and another immediately supplied. (This is said to be an important feature in the invention.) Tubes to carry off the vapours connect the retorts with a chimney, or take the vapours wherever it is found desirable to conduct them. The retorts are filled with the mixture above specified up to the line at which they are heated by the flues or otherwise; two or three shovels full of cinder or charcoal are filled in each, the door is closed, and the retort heated for about twelve hours or more. The operation is ascertained to be completed by withdrawing one of the pieces of ore and filing it; if it be found to be in a metallic condition it is completed. If the iron is to be converted into malleable iron, it is then to be "immediately " conveyed into a puddling or boiling furnace, and if the product " be not in a generally metallic state, five per cent. of small an- " thracite coal, or other carbonaceous material, is to be put into " the balling furnace with it." The iron so prepared will readily come to nature, and may be worked up in the usual way. Instead of retorts, other apparatus such as a conical limekiln may be employed, of which particulars are given in the Specification. If cast iron is intended to be made, thirty parts by weight of the carbonaceous matter must be added to 100 parts of the broken rich red ores, and the charge must be heated in the retorts for a period half as long again, instead of the twelve hours necessary in the former case.

[Printed, 10*d*. See Repertory of Arts, vol. 10 (*new series*), p. 339; and London Journal (*Newton's*), vol. 16 (*conjoined series*), p. 291.]

A.D. 1838, February 24.—N° 7578.

IVISON, MICHAEL.—Improved method of consuming smoke and applying air heated or cold to furnaces.

1st. To cause the smoke to be consumed in the furnace, a jet of steam is directed from a pipe down upon and among the burning fuel.

2nd. The air for the blast is to be applied either hot or cold, mixed with steam, and when required to be heated the air is heated by hot water or steam, instead of being subjected to the direct action of fire.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 13 (*conjoined series*), p. 141; Mechanics' Magazine, vol. 29, p. 403; vol. 30, p. 34; vol. 1, pp. 344, 377. See Patent, No. 1041.]

A.D. 1838, April 24.—N° 7625.

SMITH, Samuel Wagstaff.—Improvements in regulating heat in smelting furnaces or gas retorts. The Specification and drawings describe an apparatus for giving a self-regulating action to the blast by means of valves, by bringing into action either the force of the air as it passes into the furnace, or the pressure produced by raising its temperature when hot blast is used. The heat of gas retorts is in a similar manner regulated by the temperature thereof acting on suitable apparatus as a damper in the flue or chimney.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 21, (*conjoined series*), p. 341.]

A.D. 1838, May 3.—N° 7630.

BERRY, Miles.—Process of alloying metals by cementation. The object of the invention is to preserve copper, iron, and other metals from the effect of oxydation. For iron 2 parts of zinc and 3 parts of copper are melted in a crucible; into this alloy the iron is plunged, and if bulky it should be heated. To exclude the atmosphere the bath of zinc and copper is covered with a layer of sal ammoniac or rosin, or borate of soda; or the iron may be first dipped in a boiling solution of sal ammoniac, and then immersed in the bath of alloy. The iron thus prepared is covered with a layer of charcoal powder, and exposed to a strong red heat until the fumes of zinc begin to abate. The iron is then withdrawn from the furnace still covered with charcoal, and is plunged into water, or allowed to cool slowly. Or the alloy above mentioned may be suffered to cool, and when cool it is pulverized in a mortar. The iron is smeared with grease, or wet with water, and then plunged in the powdered alloy; it is then covered with charcoal and operated on as above described. Or the iron may be dipped in a solution of sulphate of copper, and when covered with precipitate it is plastered with potters' clay and water, then covered with a layer of zinc and borate of soda, and heated with charcoal, as above described. Instead of pulverized zinc calamine may be used.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 15 (*conjoined series*), p. 91.]

A.D. 1838, June 2.—N° 7666.

HARDY, James.—Rolling and making shafts, rails, tires, &c. of iron.

1st. The patentee's invention for making axletrees (Patent 6807 for rolling segmental bars so as to form an axle) is to be applied to other articles, square and polygonal shafts, railway rails, and tires.

2nd. Longitudinal bars of steel are introduced into the masses of metal and welded with the iron.

3rd. The rollers, instead of rolling all one way, are made to reverse their motion, so that the bars are rolled equally in both directions.

[Printed, 7*d*. See London Journal (*Newton's*), vol. 14 (*conjoined series*), p. 187; Practical Mechanics' Journal, vol. 2, p. 201. For James Hardy's Axle Patent, No. 6807, see London Journal (*Newton's*), vol. 7 (*conjoined series*), p. 168; Mechanics' Magazine, vol. 42, p. 80. This Patent was prolonged for five years, see Moore's Privy Council Cases, vol. 6, p. 441.]

A.D. 1838, June 18.—N° 7693.

GOSSAGE, William.—Manufacturing iron. A cheap material is used as a substitute for "hammer slag" in puddling pig or crude iron. Argillaceous ironstones calcined and powdered small are introduced into the puddling furnace with the pig iron either alone or mixed with powdered lime, quicklime, or carbonate of lime. The proportions required vary according to the qualities of the ores, about 450 lbs. of pig iron, 30 lbs. of calcined iron ore, and 5 lbs. of slaked lime are beneficial proportions. If the cinder does not separate easily, more lime should be used, and if the metal does not sufficiently "boil up," more powdered ironstone should be added. Also instead of cast iron for the bottoms or soles of puddling furnaces, grit stones or other fire-resisting stones slightly hollowed to receive the charge, are preferred and claimed.

[Printed, 4*d*. See London Journal *Newton's*), vol. 15 (*conjoined series*), p. 445; vol. 17, p. 329; also Patent, No. 6908.]

A.D. 1838, June 26.—N° 7704.

DOWLING, Thomas.—Preparing metals to prevent oxydation.

No Specification was enrolled.

A.D. 1838, July 10.—N° 7727.

BARNETT, William.—Manufacture of iron. The patentee claims the use of carburetted hydrogen gas or coal tar in smelting furnaces. He describes several modes of introducing the gas or coal tar, alone, or simultaneously with an air blast.

[Printed, 4*d*. See London Journal (*Newton's*), vol. 13 (*conjoined series*), p. 272; also Patent, No. 5244.]

A.D. 1838, August 3.—N° 7762.

BOURJOT, Charles.—Manufacturing iron. The object of the invention is to produce iron that may be cast and moulded, and yet have the valuable properties of malleable iron. This is proposed to be effected by taking raw cast metal and fusing it in fire-resisting vessels or cases, with a mixture of oxide of manganese (" or any other metal which cannot be reduced to the metallic " state by heat") and charcoal, in alternate layers, one layer of metal to one of the mixture. If earthen vessels be used they are placed in an oven like a potter's oven, so as to fill it, and are kept at a red heat for two or three days; they are then left to cool for two or three days. The vessels are then withdrawn, and their contents will be converted into malleable iron, capable of receiving a high polish. A particular kind of oven or furnace is also described as suitable for the process. The iron so obtained is said to be suitable for all work where forged iron is used, and as a substitute for bronze in all castings.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 14 (*conjoined series*), p. 15. As to use of Manganese, see Patents, Nos. 2363, 3097, 4397, 6837, 7448.]

A.D. 1838, August 21.—N° 7778.

BRADLEY, Richard, BARROWS, William, HALL, Joseph.—Making iron. The invention consists in the use of "tap cinder" obtained from puddling crude iron, instead of the cinder obtained from puddling refined iron, as a protection for the bottoms and sides of puddling furnaces. Tap cinder is a cheaper substitute. It is prepared by breaking it in pieces about six inches in diameter, and roasting it gradually for about eight days in a kiln like a brick-kiln, which is fully described in the Specification and drawings.

[Printed, 9*d*. See Repertory of Arts, vol. 11 (*new series*), p. 149; and London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 343.]

A.D. 1838, October 11.—N° 7828.

SANDERSON, Charles.—Smelting iron ores. In the process described in the Specification the ores, after being roasted, are placed in a furnace and subjected to as much heat as will melt the earthy particles without melting the metallic part of the ores. Proper fluxes are to be used, and charcoal or coke, and the scoria or slag is run off as soon as the earthy parts are reduced to a fluid state, leaving the iron behind in a pasty state, of greater or less consistency, according to the degree of heat applied. The iron is thus never in a complete state of fusion, and the scoria is separated at the lowest possible degree of heat, thereby avoiding the necessity of large furnaces and expensive blowing apparatus. The iron when thus separated from the scoria in a pasty mass, is to be removed by tongs, or in any other convenient manner. Various modifications of apparatus may be used. The Specification and drawings describe two furnaces, one a preparing furnace, and the other a receiving furnace, as being specially suitable. The iron, so prepared, may be made into malleable iron, or melted and cast into pigs.

[Printed, 10*d*. See London Journal (*Newton's*), vol. 17 (*conjoined series*), p. 216.]

A.D. 1838, December 1.—N° 7888.

PLAYER, John.—Furnaces and fireplaces for consuming anthracite coal and other fuel, &c. The Specification and drawings describe,—

1st. A fireplace for a steam boiler, where the anthracite, in a heated state, is supplied through a feeding chamber passing through the boiler, so that the fuel is heated before it is supplied to the fire.

2nd. A feeding chamber for heating the anthracite is attached to a smith's hearth.

3rd. A cupola having an enlarged top, which operates "as a calciner" to the furnace, the fuel and ores being therein heated before they are introduced into the furnace.

4th. A feeding chamber for heating anthracite attached to a refinery furnace.

[Printed, 1*s*. 1*d*. See Repertory of Arts, vol. 12 (*new series*), p. 201; London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 355.]

A.D. 1839, April 3.—N° 8020.

PATTINSON, HUGH LEE, and LOSH, WILLIAM SEPTIMUS.—Reducing metal ores. The invention relates solely to reducing ores of lead and antimony.

[Printed, 3*d*.]

A.D. 1839, April 5.—N° 8021.

HEATH, JOSIAH MARSHALL.—" Improvements in the manufacture of iron and steel." This Patent has been the subject of ten legal judgments, and been contested in every Superior Court in the country. The gist of the invention lay in the discovery, by Mr. Heath, of a method of employing oxide of manganese in the manufacture of iron and steel beneficially, and with the certainty of controlling its powerful pernicious properties by the counteracting influence of carbon exposed to it in the requisite proportions. The Specification describes and claims the invention under four heads.

1st. The extraction from "pure native oxides and carbonates of iron" of pure cast iron without the intervention of flux or the production of cinder.

2nd. Formation of cast steel by fusing the said pure cast iron with malleable iron or metallic oxides in such proportions as to decarburate the iron to a certain degree, and by completing the decarburation in a suitable cementing furnace.

3rd. The use of a certain portion of oxide of manganese in the process of converting cast iron into malleable iron by puddling.

4th. The employment of carburet of manganese in preparing an improved cast steel.

Under the first head the operation of producing pure cast iron is described. A blast furnace is filled with coke, charcoal, or other equivalent fuel, and thoroughly ignited. The furnace is then first charged with twenty pounds of the pure ore to 100 pounds of fuel Other charges are added at intervals, and the proportions of the ore are gradually increased at every charge until they amount to sixty-five or seventy pounds of ore to 100 pounds of fuel. The ore is to be broken small to the size of peas, and will produce about fifty pounds of pure pig iron for every 100 pounds of fuel The metal should be run into iron moulds. The metal produced is pure carburet of iron. This is converted into steel of any requisite hardness, by melting it in a cupola, with coke free from sulphur, or wood charcoal, using no more fuel than will just melt the iron, and burn away the carbon it contains to a considerable degree. The carbon is further " neutralized or removed " by adding scraps of metallic iron, or oxides of iron, or of manganese, " taking care not to decarburate the metal to such a degree as to " render it infusible, but to leave about as much carbon as exists " in cast steel." To produce a superior cast steel " sequioxide of " manganese or peroxide, which had been previously ignited," should be employed. Sometimes oxides of chrome or iron are used. The steely metal so produced is run out into cast-iron moulds, and the ingots are " converted into steel of any requisite " degree of mildness by a further process of decarburation," by cementing it with peroxides of iron, or of manganese without charcoal in a cementing furnace, the period to which the metal is subjected to the heat being proportional to the degree of mildness required. The quality of malleable iron is improved by introducing from one to five per cent. of pure oxide of manganese into the puddling furnace with the iron without mixing any other substance with it.

4thly. An improved quality of cast steel is formed " by intro- " ducing into the crucible bars of common blistered steel broken, " as usual, into fragments, or mixtures of cast and malleable iron, " or malleable iron and carbonaceous matter, along with from one " to three per cent. of their weight of carburet of manganese," and melting the charge, and pouring it into moulds in the usual manner.

[Printed, 4*d*. The duration of the Patent was prolonged, by an application to the Privy Council, for seven years. See for an account of the application for prolongation, and for reports of the ten various legal proceedings, Webster's P.C., vol. 2, p. 213 et seq. See also Repertory of Arts, vol. 16 (*new series*), p. 104; London Journal (*Newton's*), vol. 15 (*conjoined series*), p. 221; also vols. 24, 26; Mechanics' Magazine, vol. 39, p. 368; vols. 42, 58; and other publications relating to Patents and legal reports. See Patents, Nos. 2363, 3097, 4397, 6837, 7448, 7762.]

A.D. 1839, May 22.—N° 8072.

JEFFERIES, WILLIAM.—Smelting copper and other ores. The Specification and drawings describe apparatus and processes specially applicable to copper, the ores being slowly roasted and soaked in alkali and water for several days.

[Printed, 10*d*.]

A.D. 1839, May 22.—N° 8074.

VARDY, James.—Rolling iron. The Specification and drawings describe rollers adapted for rolling bars so as to consist partly of a cylindrical, partly of angular, for the purpose of making screws and screw bolts.

[Printed, 5*d*. See Inventors' Advocate, vol. 1, p. 244.]

A.D. 1839, June 18.—N° 8114.

WRIGHT, John.—" Certain improvements in mixing or alloying " iron or other metals for the purpose of increasing its strength, " tenacity, and cohesion." The invention consists in a process of and apparatus for mixing iron with other metals, as copper and others, making it applicable for constructing links for chains and other uses. A Disclaimer was enrolled December 18, 1839, omitting in the title the words " alloying " and " tenacity of cohesion."

[Printed, 5*d*. See London Journal (*Newton's*), vol. 16 (*conjoined series*), p. 121; vol. 21, p. 478, for Disclaimer; and Inventors' Advocate, vol. 2, p. 20.]

A.D. 1839, June 22.—N° 8120.

PONS, Joseph.—Hardening wood and iron, rendering wood repulsive to vermin, and proof against dry rot. The patentee uses for his purposes sulphate of iron, nitric acid, alum, saltpetre, and prussiate of potash.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 15 (*conjoined series*), p. 375; Inventors' Advocate, vol. 2, p. 19.]

A.D. 1839, June 22.—N° 8128.

JENNINGS, Joseph.—" Obtaining metal from pyrites or mundic. The amount of percentage of metal contained in the ores is ascertained by assays, as to which particulars and proportions are given. The standard flux for smelting is given; with the amount of ore found by assay to contain a ton of metal mix ¼ cwt. of fluor spar, ¼ cwt. of quicklime, 5 lbs. of common salt, ¼ cwt. of charcoal.

[Printed, 3*d*. See Inventors' Advocate, vol. 2, p. 34.]

A.D. 1839, June 25.—N° 8129.

VICKERS, William.—"Manufacture of cast steel." The invention consists in substituting for bar or blister steel, borings of iron or wrought-iron scrap, and melting the same with oxide of manganese and carbon in crucibles, to make cast steel.

The following proportions are given as suitable :—

Of wrought iron turnings, borings, or scrap	100 lbs.
Of black oxide of manganese	3 lbs.
Best ground charcoal	3 lbs.

Or cast-iron scrap may be used, the proportions of oxide of manganese being then 2 lb. 3 oz., and of cast-iron scrap 28 lbs., and of charcoal 3 lbs.

[Printed, 3*d*. See Repertory of Arts, vol. 13 (*new series*), p. 100; London Journal (*Newton's*), vol. 16 (*conjoined series*), p. 159; and Inventors' Advocate, vol. 2, p. 35. See Patents, Nos. 2363, 3097, 4397, 6837, 7448, 7762, 8021.]

A.D. 1839, August 26.—N° 8206.

TULK, Augustus John.—"Improvements in the manufacture of iron." The patentee proposes to make iron in the blast furnace wholly from Cumberland and other very rich ores, hæmatites, &c.; or from mixing the said rich ores in far greater proportions than hitherto it has been possible to do with the poorer argillaceous ores. He states that the said rich ores or hæmatites have not been able to be used because they contain very little silica, and do not furnish in the blast furnace enough slag or glassy substance to protect the fluid from the blast. He therefore mixes with his fuel and ores in the furnace sufficient quantity of glass, glassy slag, or materials for producing glassy slag, as will furnish the requisite quantity of glassy slag to protect the metal from the blast. He himself worked up the rich Cumberland and Ulverstone ores—100 parts of ore containing $67\frac{2}{10}$ iron, $28\frac{8}{10}$ oxygen, and only 4 parts silica. Allowance in the working proportions must be made for the amount of silica contained in the various rich ores, or argillaceous ores, with which they are mixed. The glass mixtures used by the patentee are 93 silica to 101 parts of lime, but glass or glassy slag is used in preference; the same slag may be used over again repeatedly, lime being applied as required. In charging the furnace (hot blast by preference), first, coke, coal, or anthracite; second, glassy materials; third, ores, are introduced. If hæmatites alone be used, two parts by weight of glassy materials are used to one part of ore.

[Printed, 4*d*. See Repertory of Arts, vol. 14 (*new series*), p. 109; Inventors' Advocate, vol. 2, p. 194.]

A.D. 1839, October 3.—N° 8232.

CUTLER, Job.—" Improved combinations of metals." The combinations consist of, first, copper, zinc, and lead; second, zinc, iron, and lead; third, copper, iron, and antimony, suitable for various purposes.

[Printed, 4*d*. See Inventors' Advocate, vol. 2, p. 227.]

A.D. 1840, January 28.—N° 8366.

WHITEHOUSE, John. — " Improvements in preparing and " rolling iron," &c. The invention is a process of and apparatus for manufacturing spoons.

[Printed, 6*d*. See Inventors' Advocate, vol. 3, p. 83.]

A.D. 1840, February 22.—N° 8389.

RALSTON, Gerard.—" Improvements in rolling puddle balls " or other masses of iron." The Specification and drawings describe a circular squeezer for compressing and rolling blooms or balls. Within a strong cast-iron frame, forming a large segment of a circle, and having its axis vertical, is placed a strong metal rolling cylinder, the vertical axis of the rolling cylinder being eccentric to that of the circular frame; so that the distance between the cylinder and frame is much wider at one part than another and grows gradually less. The cylinder revolves from the wide opening to the narrow. A bloom, being introduced between the frame and cylinder at the wide opening, is carried round by the roller, rolled and squeezed in the gradually narrowing channel, and comes out " a roll or long cylindrical piece."

Or, instead of a curved casing and rolling cylinder, a straight plate and a wedge-shaped moveable piece, moving parallel to the straight plate, may be employed for a similar purpose.

[Printed, 8*d*. See London Journal (*Newton's*), vol. 18 (*conjoined series*), p. 243; and Inventors' Advocate, vol. 3, p. 148.]

A.D. 1840, February 29.—N° 8403.

NEILSON, James Beaumont. — The invention consists in coating iron to prevent oxydation or corrosion.

[Printed, 3*d*.]

A.D. 1840, March 31.—N° 8459.

CLAY, William Neal.—" Improvements in the manufacture of iron." These consist in making malleable iron in a reverberatory furnace from rich iron ores, such as those which, when calcined, would contain at least 45 per cent. of iron, by combining therewith 28 per cent. or upwards of carbonaceous matters. The ores are broken or ground by rollers very small, and sifted through a fine sieve. 30 or 40 parts of fuel (also broken small and sifted, such as coal slack, coke, or charcoal) are mixed with 100 parts of pulverized ore, and are thrown into a puddling furnace, stirred every five minutes, and are afterwards operated on in the way in which malleable iron is treated. The proportions of carbonaceous matter will vary, but always exceed those given; for instance, where 100 parts of ore contain 50 of iron 30 parts of carbonaceous matter will be required, and for every additional 2 parts of iron 1 part of carbonaceous matter should be added. Pig or scrap iron, of a weight equal to that of the ore, may be added with advantage in the furnace at the time when the ore and fuel are well heated.

[Printed, 4*d*. See Repertory of Arts, vol. 16 (*new series*), p. 118; London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 369; and Inventors' Advocate, vol. 3, p. 229.]

A.D. 1840, April 16.—N° 8479.

BANKS, Samuel Marlow.—" Improvements in the manufac-" ture of iron."—These consist in conveying into the blast furnace coal or coke, or charcoal, limestone, ironstone, ore, or other material useful for accelerating the process of manufacture or improving the quality of the iron, by reducing the said materials to fine particles and causing them to fall into the blast pipe, and so meet the blast and be carried with it into the furnace. By these means the materials are applied when and where they are most effective. Any suitable mechanical means may be used, and those used by the patentee are described in the Specification and drawings.

[Printed, 5*d*. See London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 370; Mechanics' Magazine, vol. 33, p. 445; and Inventors' Advocate, vol. 3, p. 275. See Patent, No. 6207.]

A.D. 1840, May 28.—N° 8518.

GUEST, Sir John Josiah, and EVANS, Thomas.—" Im-" provements in manufacturing iron," &c. The invention consists in introducing steam into the refinery or puddling furnace, " forced upon, or into, or in contact with the metal." Any suitable means may be employed. The Specification and drawings describe furnaces having telescopic injection tubes.

[Printed, 9*d*. See Repertory of Arts, vol. 16 (*new series*), p. 281; London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 447; Mechanics' Magazine, vol. 33, p. 381; Inventors' Advocate, vol. 3, p. 23; and Engineers and Architects' Journal, vol. 3, p. 396.]

A.D. 1840, November 3.—N° 8677.

EMMERSON, RICHARD FARGER.—Coating iron tubes. The invention consists in coating tubes with tin or alloy of tin.

[Printed, 3*d.*]

A.D. 1840, November 25.—N° 8723.

ROBERTS, ROBERT.—" New method or process of casehardening iron." The iron article intended to be casehardened is heated red hot; then dipped in a bath of molten cast iron (or covered in any way with fluid cast iron); and then immediately immersed in cold water.

[Printed, 3*d.* See London Journal (*Newton's*), vol. 20, p. 109; Mechanics' Magazine, vol. 34, p. 446; Inventors' Advocate, vol. 5, p. 358; and Engineers and Architects' Journal, vol. 4, p. 234.]

A.D. 1841, January 13.—N° 8820.

SCHAFHŒUTL, CHARLES, MANBY, EDWARD OLIVER, and MANBY, JOHN.—Improved reverberatory furnaces. The Specification and drawings describe furnaces in which the fire is made to surround the hearth, except at the working door and the canal leading to the chimney, so that the metals "are acted upon by the " heat and flames from all sides instead of from one;" and also " fuels giving out shorter and less flames than bituminous coals, " such as anthracite," may "be advantageously used," in which case a stronger draft is recommended.

[Printed, 9*d.* See Mechanics' Magazine, vol. 35, p. 144; and Inventors Advocate, vol. 5, p. 84.]

A.D. 1841, February 22.—N° 8855.

BOOKER, THOMAS.—" Improvements in the manufacture of iron." These consist in making a connection between the refinery and the puddling furnaces, which may be of any suitable construction, so that "the heated metal from the refinery furnace" may be run or passed into the puddling furnace, without being first permitted to cool.

[Printed, 9*d.* See Repertory of Arts, vol. 17 (*new series*), p. 27; London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 107; Mechanics' Magazine, vol. 35, p. 208; Inventors' Advocate, vol. 5, p. 134; Transactions of Society of Arts, vol. 54, p. 25; and Engineers and Architects' Journal, vol. 7, p. 76.]

A.D. 1841, April 22.—N° 8930.

BROWN, HENRY.—" Improvements in the manufacture of steel." *These consist in* cementing iron in a granulated state in close pots with carbon. The iron is prepared in a puddling furnace as if it were to be puddled, but the operation stops short as soon as the metal is in a granulated state, before it becomes a pasty mass. It is then broken or pounded small, and passed through a sieve having 20 meshes to an inch. The smaller the grains are the better fitted are they for the process. The pulverized iron is put in a cementing furnace in pots or chests, about 10 feet long, 3 feet wide, and 3 feet deep, with wood charcoal sifted through a sieve with meshes ¼ inch square. The pots are exposed to great heat for from 30 to 60 hours, and the steel is then broken up in pieces in the usual manner. The process of charging the pots or chests with alternate layers of charcoal and pulverized metal, the latter contained in wood or iron frames, is fully described.

[Printed, 3*d*. See Repertory of Arts, vol. 17 (*new series*), p. 179; London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 32; Mechanics' Magazine, vol. 35, p. 365; and Inventors' Advocate, vol. 5, p. 277.]

A.D. 1841, April 24.—N° 8935.

POWELL, Lancelot, and ELLIS, Robert.—" Improvements " in manufacturing iron." The construction and operations of the refining, puddling, and boiling furnaces are described as known before the date of the Patent. The improved process consists in bringing iron, while in a molten state, from the blast furnace direct to the boiling furnace, and there subjecting it to the action of streams of blast or atmospheric air directed upon the metal while the boiling process is going forward. With a charge of 4½ cwt. of iron (from Welsh ores) a stream of air introduced through " a pipe of " one inch diameter, with a pressure of 1½ to 2 lbs. on the square " inch, leads to a beneficial result."

[Printed, 4*d*. See London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 33; Mechanics' Magazine, vol. 35, p. 366; and Inventors' Advocate, vol. 5, p. 277. Patent, No. 1370.]

A.D. 1841, May 14.—N° 8959.

GREGORY, James, and GREEN, William.—" Improvements " in the manufacture of iron and steel." These consist in submitting the crude pig-iron to the action of water. The iron, in the form of pigs, or broken small, is immersed in water, and allowed to remain exposed to its action " until there is no longer " any change produced upon it; a period of from two to three " weeks is generally sufficient for this purpose. The appearance " of an oily-looking scum on the surface of the water indicates "that the water has produced its full effect upon the iron." Running water may be used, but standing water is preferred, as its scum indicates when the operation is completed. This process "causes the iron to become softer and tougher." If the iron is required to be of "close texture of that kind called brittle iron;" it is to be heated to a bright red heat and submitted to the action of cold water by sprinkling or immersion. If the iron be of impure quality it is fused in a "finery." Iron so treated is superior for casting and for conversion into wrought iron. The improved process for refining, which may be used alone, or in conjunction with that just described, is as follows:—The iron is melted "in a reverberatory or other suitable furnace," and then poured, "while in its melted state, through a vessel, the bottom of which is perforated with holes about ¼ inch in diameter, lined with clay. The fused metal is received in a vessel of cold water," of any size, by preference it should be so deep "that the drops of metal may be well cooled." Iron is considerably refined by this operation; it "possesses a close texture, and is of a white colour," and is "much better adapted for conversion into steel than the iron manufactured in the ordinary method."

[Printed, 3*d.* See London Journal (*Newton's*), vol. 21, (*conjoined series*), p. 34; Mechanics' Magazine, vol. 35, p. 413; and Inventors' Advocate, vol. 5, p. 324. See Patents, Nos. 759, 4151.]

A.D. 1841, July 7.—N° 9018.

MALLET, Robert.—Protecting iron, &c., from corrosion and oxidation. A coating of an alloy of zinc, mercury, and potassium or sodium is used, covered with caoutchouc and other varnishes.

[Printed, 5*d.*]

A.D. 1841, August 27.—N° 9055.

MOREWOOD, Edmund.—Preserving iron, &c. from oxidation. The iron is tinned, and then immersed in molten zinc.

[Printed, 4*d.*]

A.D. 1841, November 2.—N° 9135.

BRUNTON, William.—Dressing ores and separating metals or minerals. A complicated apparatus is described, in which ores or metals are separated and classified according to their specific gravity, by precipitating them in a tank of water. The heavier, falling quicker, are separated from the lighter falling more slowly.

[Printed, 1*s.* 9*d.*]

A.D. 1841, November 11.—N° 9151.

ALLASTER, George.—Improvements in "balling and blooming iron." A particular kind of squeezer is described. Its bed or foundation is not secured firmly to the ground in every part, but at one end only, by means of a joint or hinge fixed at that extremity, so that if the metal be too hard and resists the force applied to the squeezer there is no breakage, but the whole machine is lifted up from the floor on its hinge.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 21 (*conjoined series*), p. 168. By a Disclaimer enrolled May 11, 1842, the word "balling" in the title was disclaimed.]

A.D. 1842, March 21.—N° 9298.

JESSOP, Sydney.—Preparing wrought iron for wheel tyres, rails, &c. "A quantity of bar iron" is rolled into bars of the requisite shape, and these are introduced into a carbonizing furnace, described in the Specification and drawings. The bars are so placed that those surfaces intended to form wearing surfaces, as of wheels or rails, are brought into contact with and exposed to the action of charcoal or carbonizing fuel, and are in this manner "hardened to any depth required," while those parts of the bars which are so exposed "remain soft or uncarbonized."

[Printed, 1*s*. See Record of Patented Inventions, vol. 1, p. 139.]

A.D. 4842, May 19.—N° 9351.

BRUNTON, William.—Dressing ores, &c. This is the same invention which was patented by the same person, November 2, 1841, N° 9135, and this Patent extends to the colonies only, the former one having been confined to England, Wales, and Berwick-upon-Tweed.

[Printed, 1*s*. 7*d*.]

A.D. 1842, May 24.—N° 9365.

BOYDELL, James (junior).—Manufacture of keel plates, gates, gate posts, &c. Keel plates, gates, fences, &c., are made of iron by welding the parts together by rolling.

1st. Keel plates are made trough-shaped, either out of one plate or by joining and welding three plates together. The two side plates are first joined to the bottom one by wooden clamps, then put into a furnace to take a welding heat, the wooden clamps being burnt off. The three pieces, being in a trough shape, are then passed through rollers of the requisite shape to weld them at the corners and form a keel plate. If only one flat plate is used a series of rollers must be employed. so as gradually to deepen the trough shape.

2nd. Iron gates or fences are made by joining bars together by wire or wooden clamps, heating them to a welding heat and passing them through rollers, causing them to be elongated in the direction in which they are rolled, and welding the parts placed in contact.

3rd. Gate posts are formed with an enlarged foot or block of slag or scoria (such as that tapped from the blast furnace), by pouring the fluid slag in a mould in which the post is set upright.

[Printed, 5*d*. See Repertory of Arts, vol. 1 (*enlarged series*), p. 27; London Journal (*Newton's*), vol. 23 (*conjoined series*), p. 105; Mechanics' Magazine, vol. 38, p. 60; and Record of Patented Inventions, vol. 1, p. 316.]

A.D. 1842, May 31.—N° 9373.

DE MECKENHEIM, Louis Nicolas.—" Improvements in the " manufacture of iron." These have for their object the utilizing the superabundant gases cooled by blast or other furnaces, by the use of furnaces of improved construction, and receivers, retorts, &c. The Specification is long, and the drawings numerous.

First. The gases evolved from the blast furnace are drawn off by pipes placed 10 or 15 feet below the tunnel head, " that is, from " 0.28 to 0.30 of the entire height." The gases are forced into the pipes by the compression of the blowing engine, aided, if necessary, by " an air-pump, which, by creating a vacuum, will " form a current in the direction required." Or the " ventilator " will fully answer this purpose." The gases are collected and condensed by suitable apparatus, and are used for heating other furnaces, as for " smelting, refining, puddling, and reheating iron." Or for heating " the apparatus for hot blast," the boilers of steam engines, kilns for roasting the iron ores, or " carbonizing retorts," or gas retorts, or lime or brick kilns, or other purposes.

Secondly. Furnaces are constructed connected with each other (as described), so that the gases and flames may be employed in heating them in succesion.

Thirdly. The properties of all fuel are separated, and used separately or together in any furnace. The fuel is carbonized in closed retorts, and the hydrogen gas is collected and purified in suitable apparatus, and may be used in any suitable operation of heating retorts or furnaces, or be injected into the blast furnace. The coke is used as fuel for the blast or other furnaces.

The bicarbonated hydrogen may be used alone for making malleable iron, either in the usual way by reducing the ore to pig-iron, or by the " direct or Catalan method."

[Printed, 1*s*. 1*d*. See Record of Patented Inventions, vol. 1, p. 338; also Nos. 1642, 6211.]

A.D. 1842, June 9.—N° 9382.

NASMYTH, James.—Apparatus for "forging, stamping, and cutting iron," &c. The Specification and drawings describe Mr. Nasmyth's "direct action steam hammer" and apparatus connected therewith.

[Printed, 1*s*.]

A.D. 1842, October 20.—N° 9495.

BUDD, James Palmer.—" Improvements in the manufacture of iron." Anthracite coal is to be used in combination with a blast of air in its natural or unheated state. This is done by using a blast of at least 2½ lbs. pressure on the square inch, by preference it is used " considerably higher." Water tuyeres are also used, and 4 or more tuyeres in combination with the unheated blast. The patentee in a large furnace, uses 6 tuyeres, 2 through the back arch of ¾ of an inch diameter, and 2 through each side arch, two front ones an inch in diameter, and the two back ones 1¼ inches in diameter. The density of the blast must increase with the size of the furnaces, and " the higher the pillar of blast, the greater " will be the advantages derived from the process."

[Printed, 7*d*. See Repertory of Arts, vol. 1 (*enlarged series*), p. 325; and Mechanics' Magazine, vol. 38, p. 488.]

A.D. 1842, October 20.—N° 9496.

LONGMAID, William.—Treating ores and obtaining products, alkali, &c. The invention relates specially to the application of common salt, in large quantities, to minerals containing sulphur, to take up the sulphur, and to manufacture alkali.

[Printed, 7*d*. See Repertory of Arts, vol. 2 (*enlarged series*), p. 31; London Journal (*Newton's*), vol. 24 (*conjoined series*), p. 274; and Mechanics' Magazine, vol. 39, p. 247.]

A.D. 1842, December 22.—N° 9568.

BEAMAN, JOSEPH.—Manufacture of malleable iron.

No Specification was enrolled.

A.D. 1843, January 26.—N° 9607.

BOYDELL, JAMES.—Manufacture of "metals for edged tools."

1st. Steel is combined with iron for making edge tools, by causing "a slab or plate of steel to be piled on one or more, or "between one or more plates of steel."

2nd. In making spades, instead of forging each "mould" and half mould separately, several are to be made in the same bar.

3rd. Steel for edge tools is to be manufactured by melting malleable iron (by preference "strap iron") with coke in a blast furnace or cupola. It is then run into pigs and puddled, and converted into malleable iron in the same way as cast pig-iron. It is then drawn into bars, and converted into steel, suitable to be manufactured into edge tools, "at a small cost compared with the "steel now used."

[Printed, 6*d*. See Repertory of Arts, vol. 2 (*enlarged series*), p. 152; and London Journal (*Newton's*), vol. 26 (*conjoined series*), p. 184.

A.D. 1843, January 31.—N° 9617.

THORNEYCROFT, GEORGE BENJAMIN.—"Improvements in furnaces," and also in "manufacturing iron."

1st. Reverberatory furnaces are made so as to admit air through the bridge, which is hollow to allow the air to pass up between the fire and the furnace. If the furnace have flues along the two sides to allow of a current of air passing through and under the bottom of the furnace to keep the bottom and sides cool, the heated air from these flues is admitted through the hollow bridge, and will be found beneficial.

The 2nd part relates to an improved method of cutting sheet iron, by moving the upper cutter by means of a rotatory axis.

The 3rd part relates to improved grooved rollers for rolling plates wider than 11 inches.

4th. In making files the outer surfaces only are made "of foreign iron," which is plated on English iron. Slabs of foreign iron are applied to the outer surfaces of the piles, the interior being of more common iron. The piles are then rolled into bars or rods, and converted into steel, and made into files in the ordinary way.

[Printed, 1*s.* 4*d.* See Repertory of Arts, vol. 2 (*enlarged series*), p. 129.]

A.D. 1843, February 21.—N° 9641.

BLACKWELL, Benjamin Brunton, and NORRIS, William.—Coating iron nails, screws, nuts, &c., with other metals. The iron articles are first casehardened or covered with lead, or an alloy of lead, such as lead and tin, and then covered with a coating of copper.

[Printed, 3*d.*]

A.D. 1843, March 16.—N° 9664.

PERKINS, Angier March.—" Improvements in the manufac- " ture and melting of iron," &c. " A blast of highly heated steam " may be used " in the place of the hot or cold air blast." " The quan- " tity of steam required to raise the temperature of the furnace to " the melting point of iron is about in the proportion of 100 lbs. of " steam to 100 lbs. of coke," with which " 500 lbs. of iron have " been melted in two hours in a cupola of the capacity of two " feet cube." " A nozzle $\frac{3}{16}$ of an inch in diameter, when the " steam is at a pressure of 60 lbs. per square inch and afterwards " heated to 600° Fahrenheit, is sufficient to produce the above " effect." The tuyere is conical, tapering from six inches diameter to two inches. The nozzle is placed nine inches from the inner opening of the tuyere, and the blast of steam takes in sufficient air to supply the oxygen required. The degrees of heat and pressure may be varied, and the steam used " conjoined with the use of air." The steam boiler should be able to generate as many cubic feet of steam of 60 lbs. pressure per square inch as will equal in weight the fuel necessary for smelting the iron or ore. The apparatus for superheating the steam may be of any suitable form, a coil of wrought iron pipe of " one inch external " and " $\frac{5}{8}$ inch internal " diameter," and about " thirty feet long," will answer the purpose. The apparatus may also be used for evaporating fluids and disinfecting oils.

[Printed, 3*d.* See Repertory of Arts, vol. 2 (*enlarged series*), p. 294.]

MANUFACTURE

OF

IRON AND STEEL.

PART II.

A.D. 1843, April 7.—Nº 9690.

BOYDELL, JAMES.—Manufacturing bars of "iron and other metals." The iron bars are coated with steel. The iron is rolled of the requisite shape and piled with steel. The pile having steel on the outside and iron in the interior is heated and rolled through grooved rollers; "by this means the iron of the bar will be enveloped "in the steel."

[Printed, 3*d*. See Repertory of Arts, vol. 3 (*enlarged series*), p. 45. See Patent, No. 9607.]

A.D. 1843, June 23.—Nº 9800.

TROUGHTON, NICHOLAS.—"Improvements in dressing ores "requiring washing." Pulverized ore is washed in a sieve (which is fully described with the working machinery) so that the lighter particles are carried horizontally further and further from the heavier particles, the principles of gravitation and centrifugal action being employed for this purpose.

[Printed, 10*d*. See Repertory of Arts, vol. 3 (*enlarged series*), p. 129; London Journal (*Newton's*), vol. 25 (*conjoined series*), p. 318; and Mechanics' Magazine, vol. 40, p. 383.]

A.D. 1843, July 6.—Nº 9816.

BOYDELL, JAMES.—Metallic roofs, and "joining sheets or plates of metal."

The metallic roofs are made with grooved iron rafters recessed to receive *plates of* iron, or iron lathes, or tiles, or wood, to which *boards or laths* may be affixed. Plates of iron are joined by temporarily attaching the plates together, and then subjecting them to a welding heat, and passing them through rollers so as to weld together the parts in contact.

[Printed, 1*s*. 8*d*. See Repertory of Arts, vol. 4 (*enlarged series*), p. 70; and Engineers and Architects' Journal, vol. 7, p. 35.]

A.D. 1843, July 22.—N° 9849.

DANIELL, WILLIAM.—" Improvements in rolling iron into " plates or sheets." These consist in avoiding the repeated processes of rolling, piling, and reheated, by taking a bloom about 6 inches wide and 5 inches thick, and cutting or sawing it into pieces of about four or six inches long; these pieces are immediately rolled " the grain of the pieces when passing through between the " rollers, being kept vertical," and " the upper and under surfaces " being those which result from the cutting," they are then finished off into thin plates ready for the tinning process.

[Printed, 3*d*. See Repertory of Arts, vol. 3 (*enlarged series*), p. 220; and Engineers and Architects' Journal, vol. 7, p. 60.]

A.D. 1843, October 5.—N° 9899.

BODMER, JOHN GEORGE.—" Improvements in grates, furnaces, " and boilers, and also in manufacturing and working iron or " other metals, and in machinery connected therewith." The Specification and drawings, which are requisite in order to enable the descriptions to be fully understood, describe several distinct inventions.

1st. A furnace is described having moveable grate bars, which are gradually carried forward by screws in whose threads the bars rest; a feeding hopper deposits fuel on the bars as they advance. Reference is made to Mr. Bodmer's Patent, May 26, 1834, for fuller explanations. A rocking motion is given to the bars by cutting the threads regular to a certain distance, and then causing them to assume the form called " drunken," as shown in the drawings.

2nd. A stuffing box and packing consisting of rings of soft metal, are described, and the same principle is applied to pistons.

3rd. A lathe is constructed specially adapted for cutting the " oscillating grate screws " or the patterns for them.

4th. The " improved grate " is applied to a " furnace of cementation," of the ordinary construction, for the manufacture of steel, so as to obtain great regularity in the heat applied. Instead of breaking the bars they are cut into cubes by a revolving or reciprocating tool, and a layer of cubes is placed alternately with a layer of charcoal until the box is filled.

5th. A furnace for cementing steel is so constructed that the charge is perpetually renewed, and the steel abstracted when the process is complete, without stopping the operation of the furnace. A conical shaft of fire bricks is built (by preference) wide enough to receive a boy; it is surrounded with a spiral flue communicating with the furnace at some distance above the bottom of the shaft. The lower part of the shaft is filled with sand level with the lowest part of the flue, and the upper part is charged with alternate layers of "cubes of steel" and charcoal to the top, and the whole is covered in. The fire is lighted, and as soon as the lower portion of the charge has undergone sufficient cementation (which is ascertained by withdrawing certain "test bars") the sand is removed from below, and the whole charge is allowed to descend a certain distance in the shaft. As the steel is converted the cement and steel are removed by an opening made below the flue, and a fresh charge is inserted at the top of the shaft, the air being excluded by air-tight lids. The operation may be conducted for "months and even years without "interruption," and the steel and materials for cementation removed "less or more frequently," so that a "softer or harder steel may "be produced accordingly."

6th. A furnace for smelting iron is described. The basin or hearth is surrounded with a number of flues connected with a vertical shaft rising out of the arch or dome above the hearth, and with a horizontal shaft below, leading to a chimney in which there is a fan to create a blast by drawing down the air. The furnace is filled with coke up "to a certain height" in the vertical shaft, "fire is set to it," and the fan set in motion. The air is drawn down the vertical shaft by the operation of the fan below, and air rushes in at the top and supplies combustion. A tall chimney connected with the horizontal shaft may supply the place of the fan, which is, however, preferred. Iron and limestone are put in at the top of the vertical shaft and more fuel. As the iron melts it falls down into the basin, which is immediately below the shaft, and is heated by the fire above and the flames drawn down the flues which surround it. To increase the combustion apertures are left in the vertical shaft to admit air, which may be opened and closed at pleasure. "By this arrangement a large quantity of "iron can be melted in a very short time, and with comparatively "little fuel, and moreover the iron can be deprived of its carbon "if required, to a very great extent, by allowing the coke to burn "down in the shaft, and the atmospheric air to come in contact "with the iron in the basin." This furnace may be used for smelting other metals, and even "for the refining and puddling "process of iron."

7th. A double furnace is constructed having one fireplace in front, while the back part is divided by a horizontal division or shelf into two compartments, an upper and a lower one, each having its own bridge, and each connected with a separate chimney. The lower compartment serves as for the puddling process, and when that is completed its chimney is closed with a damper, and while the balls are being made and removed all the blast flames and heat pass into the upper compartment, where the iron undergoes "a kind of refining process," and is afterwards dropped down into the puddling compartment through a slot in the upper bridge. The improved moveable grate may be applied to puddling furnaces.

8th. The improved moveable grate is applied to a furnace containing a number of bent pipes to heat air to supply the hot blast.

9th. Rollers for rolling "endless saw blades" are described. A band or hoop of steel is heated and passed over two rollers which are set in motion, the distance between them is gradually increased until the heated hoop becomes an endless riband of the required dimensions. "The saw blade may be rolled to the length from "four to twenty feet or more." It is ground and toothed and then "may be applied as a continually acting saw by running over two "pullies proportionate in diameter to the length of the saw blade, "and to the work it is intended to perform, and the blade may be "guided by an appropriate guide on its working side and between "the periphery of the pullies and the piece of timber it has to "cut." The carriage to which the timber is fixed should be "advanced by a regular screw or rack motion."

[Printed, 1s. 9d. See Mechanics' Magazine, vol. 40, p. 271; and Engineers and Architects' Journal, vol. 7, p. 153.]

A.D. 1843, October 18.—N° 9909.

NEVILL, JANION RICHARD.—Separating metals. The invention relates to a method of separating silver and lead from copper.

[Printed, 3d.

A.D. 1843, October 18.—N° 9911.

DETMOLD, Julius Adolph.—Improvements in "furnaces or "fireplaces," &c. The invention is intended to obviate the disadvantages arising "from the formation of combustible gases in the "furnace, and the passing of undecomposed air through the "grate," and also from cold air being "drawn into the furnace "through the door when open, and through every opening or "crevice" in the furnace.

These objects are to be effected, 1st, by making the grate much deeper than ordinary, from three to five feet, according as the coal is caking and bituminous, or light in quality.

2nd. Instead of relying on the draft of a chimney, a blast is forced into the ash-pit below the grate (the ash-pit having an air-tight door), and up through the grate. The body of fuel, except the stratum immediately above the bars, will not be maintained at a high heat, and all that is combustible in the fuel is converted into combustible gases.

3rd. The "combustion of these gases" is effected "by forcing "amidst them in their passage over the fire bridge heated and "compressed atmospheric air" supplied from pipes heated in the chimney, and regulated by valves, and introduced through a row of tweers placed in front of the bridge. The pressure of the air within the furnace must always exceed that of the atmosphere. Any kind of coal may be used, and anthracite is particularly beneficial. These closed furnaces are specially adapted for the manufacture of iron; and the Specification and drawings describe how they are to be worked. In refining iron a blast of hot air is directed on the iron through tuyeres converging towards the centre of the hearth, and having a pitch of twenty-five or thirty degrees. Iron may be advantageously refined and puddled in the same furnace.

[Printed, 11*d*. See London Journal (*Newton's*), vol. 25 (*conjoined series*), p. 73; and Mechanics' Magazine, vol. 40, p. 379.]

A.D. 1843, November 18.—N° 9946.

WALL, Arthur.—"Improvements in the manufacture of iron." The operations are divided into two classes.

1st. While the iron is in a state of fusion, two compounds (A and B) are added to it. A consists of a mixture of steel or iron filings or cuttings and rosin, 2 lbs. of cuttings to 5 lbs. of rosin. These are made into balls of 5 lbs. weight each, and are thrown on the iron when in a state of fusion in the smelting or other furnace, in the proportion of one ball to 5 cwt. of iron. Instead of rosin, analogous substances, pitch, tar, &c., may be used; a few pounds of charcoal may also be added to the ball. B consists of a mixture of salt, rosin, and charcoal (of which the relative proportions are not given), and is to be added after A has been applied, in the proportion of 1 lb. of mixture to 1 cwt. of iron. Instead of salt, other fluxes, nitre, or fixed alkalis may be used.

2nd. While the metal is "congealing" or solidifying, electric currents are to be passed through it in every possible direction, in the manner specified.

[Printed, 3*d.* See London Journal (*Newton's*), vol. 24 (*conjoined series*), p. 426; and Engineers and Architects' Journal, vol. 7, p. 197.]

A.D. 1843, November 25.—N° 9964.

VIVIAN, Alexander.—Dressing ores. An apparatus is described for washing those ores which require the impurities to be well separated from the metallic particles by washing.

[Printed, 9*d.*]

A.D. 1843, December 5.—N° 9974.

NEWTON, William.—Extracting metals from ores. The invention is specially intended to be applied to separating sulphur from sulphurets of copper, iron, lead, and zinc. A calcining apparatus, having several chambers for gradually heating and calcining the ores, and the mode of obtaining free sulphur from the ores, are described.

[Printed, 1*s.* 5*d.*]

A.D. 1843, December 28.—N° 9996.

THORNEYCROFT, George Benjamin.—"A machine for "rolling, squeezing, or compressing puddled balls of iron, and "also for crushing or grinding other substances." The machine described is a kind of circular squeezer; a roller, with its axis horizontal, squeezes the balls between its surface and "a curved "excentric surface." Side plates or guards are affixed to the framing of the machine "to prevent the too great elongation of *the metal.*" In this respect the patentee specially distinguishes *his machine* from the circular squeezer (see Patent, N° 8389), having its axis vertical. A modification of this machine is applied to crushing and grinding sandstone, clay, &c.

[Printed, 1*s*. See Repertory of Arts, vol. 4 (*enlarged series*), p. 221.]

A.D. 1843, December 28.—N° 9999.

BUDD, Edward, and MORGAN, William.—" Improvements " in reducing copper and other ores, and furnaces for heating such " ores." The invention is specially applicable to the working of copper and zinc ores.

[Printed, 1*s*. 4*d*.]

A.D. 1844, January 1.—N° 10,004.

LONGMAID, William.—Manufacture of copper, tin, zinc, and peroxide of iron. The ores to be operated upon are those of copper, tin, and zinc, they are treated with common salt and muriatic acid.

[Printed, 4*d*.]

A.D. 1844, February 8.—N° 10,038.

SOUTHALL, Thomas, and CRUDGINGTON, Charles.—" Improvements in the manufacture of iron." These consist in treating iron, when in a melted state, while being manufactured into malleable iron, with a mixture consisting of equal parts by weight of sulphur, nitre, borax, and alum, with half a part by weight of soda or potash, or 1½ lb. of the mixture must be mixed with about 4 cwt. of iron in the puddling furnace if the iron be intended to be converted into malleable iron. If the iron be intended to be converted into steel, it is said that 4 lbs. of the mixture will be required for 4 cwt. of iron.

[Printed, 3*d*. See Repertory of Arts, vol. 6 (*enlarged series*), p. 244; and Engineers and Architects' Journal, vol. 7, p. 321.]

A.D. 1844, February 24.—N° 10,073.

JACKSON, Peter Rothwell. — Improvements in cylinders, wheels, &c. The invention relates to the manufacture of wheels, &c. The " vertical wheel-cutting engine" is used for making moulds for toothed wheels in the sand. Improved apparatus for driving shafting wheels is also described, with other improvements.

Guano is mentioned as a suitable material to be used in the place of bonedust for casehardening iron.

[Printed, 4*d.* See London Journal (*Newton's*), vol. 28 (*conjoined series*), p. 16.]

A.D. 1844, April 27.—N° 10,159.

WALL, ARTHUR.—Improvements in the manufacture of steel, copper, &c.

No Specification was enrolled.

A.D, 1844, May 25.—N° 10,204.

LOW, CHARLES.—Improvements in making iron and steel. The patentee makes a mixture consisting of about 42 lbs. of black oxide of manganese, of plumbago 8 lbs., wood charcoal 14 lbs., saltpetre 2 lbs. These materials should be ground fine, and well mixed. The mixture is introduced into the blast furnace in proportions of about 66 lbs. of mixture to every charge calculated to produce 480 lbs. of metal. The mixture is to be thrown on the iron in the puddling furnace two or three pounds weight at a time, and stirred up with the metal until 66 lbs. are used, or until the iron is brought to nature. The mixture may be advantageously used in the above proportions, or nearly, in any of the processes of making iron.

In manufacturing cast steel from malleable iron, two or three pounds of the mixture are to be put in the melting pot " to " every 30 lbs. of cast steel;" or the ingredients may be added in the same relative proportions to the malleable iron while it is being made. " Then the application of a moderate heat will fuse " the iron in contact with the mixture, and convert it into cast " steel."

[Printed, 3*d.* See London Journal (*Newton's*), vol. 26 (*conjoined series*), p. 17; Mechanics' Magazine, vol. 42, p. 109; and Engineers and Architects' Journal, vol. 8, p. 90.]

A.D. 1844, May 30.—N° 10,208.

FENTON, JAMES.—Manufacture of alloys. An alloy consisting of thirty-two parts copper, fifteen parts block tin, and one part sheet brass, forms "a hardening metal" for steps, bearings, &c. This alloy may also be advantageously combined with zinc, spelter, or calamine.

[Printed, 3d.]

A.D. 1844, June 4.—N° 10,218.

GRIFFITHS, Paul.—"Improvements in washing the products "evolved from furnaces." The Specification and drawings describe apparatus specially adapted for washing the refuse obtained from smelting lead, copper, and zinc.

[Printed, 9*d*.]

A.D. 1844, June 8.—N° 10,222.

MOREWOOD, Edmund and ROGERS, George.—Coating iron, &c. The Specification describes a process of casting iron in metal moulds, and cleansing it and coating it with tin or other metals.

[Printed, 4*d*.]

A.D. 1844, June 21.—N° 10,233.

RUSHTON, Thomas Lever.—"Improvements in the manufac-"ture of iron." The "hammer slack, roll scale, red ore, calcined "ore, and other oxides" usually mixed with iron in the puddling furnace, are mixed with pulverized carbonaceous matter in the proportion of "seventeen up to (but not including) twenty-eight "per cent. of carbonaceous matter." The proportions of twenty-eight per cent. and upwards being claimed by William Clay (see Patent, A.D. 1840, March 31.—N° 8459.) "To 480 lbs. of "Number 4 pig iron" the patentee adds "84 lbs. of Lancashire "hæmatite ore pulverized and mixed with 20 lbs. of powdered "coke." If the proportion of hæmatite be increased, that of coke must also be increased.

"Clay, argillaceous ironstone, or other substances containing "alumina," ground fine, are to be added to those ores likely to produce "red short" iron, to cure that defect, in proportions of from four to ten per cent. by weight of the ore employed.

A mixture in proportions of about 150 lbs. of tap cinder containing seventy-one per cent. of protoxide of iron to 150 lbs. of Lancashire hæmatite, 50 lbs. of ground Wortley fire-clay, 50 lbs. of chalk, and 100 lbs. of coke dust, may be advantageously combined and manufactured, either with or without pig or refined iron, in reverberatory furnaces into malleable iron.

[Printed, 4*d*. See Mechanics' Magazine, vol. 42, p. 122; London Journal (*Newton's*), vol. 29 (*conjoined series*), p. 103; and Engineers and Architects' Journal, vol. 8, p. 54.]

A.D. 1844, June 24.—N° 10,236.

DAVIES, Rees.—"Improvements in the manufacture of iron." The Specification and drawings describe a furnace constructed for the use of anthracite coal, alone or mixed with other fuel, having chambers so arranged that the charge of fuel and ore and flux "are brought into a state of ignition by a draught of atmo-"spheric air," before being projected into the blast furnace.

[Printed, 1*s*. See London Journal (*Newton's*), vol. 29 (*enlarged series*), p. 34.]

A.D. 1844, August 1.—N° 10,283.

STRATTON, Benjamin Tucker.—"Improvements in welding "sheet iron for shipbuilding and other purposes." Grooved or corrugated plates of iron, or plates indented in other shapes, are heated to a welding heat, and are placed face to face, so that corresponding indentations are opposite, and form tubes, while the unindented or flat parts (forming longitudinal flanges) are in contact. The plates are passed between suitable rollers, and the parts in contact are welded, forming either tubes with longitudinal flanges or sheets with series of hollow ribs suitable for rails, railway wheels, roofs, parts of ships, &c.

[Printed, 5*d*.]

A.D. 1844, October 10.—N° 10,343.

BROWN, John Bower.—"Improvements in combining cast "steel with iron," and in carriage springs. The cast steel is poured into a mould so as to surround an iron bar properly heated, and the steel and iron so combined is rolled out into bars, and made into tyres of railway wheels. Other parts of the invention relate exclusively to improved carriage springs.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 30 (*conjoined series*) p. 399.]

A.D. 1844, October 22.—N° 10,362.

NAPIER, James.—Treating mineral waters and obtaining metals therefrom. Sulphuric acid is mixed with the mineral waters con*taining copper*, and the copper contained in them is precipitated *upon the surface* of iron exposed to their action.

[Printed, 4d.]

A.D. 1844, November 2.—N° 10,378.

BRUNTON, William.—Improvements in apparatus for dressing ores. The ores are washed by submitting them to the action of a stream of water when placed " on an inclined plane continuously " or occasionally moving up against the stream," until it passes beyond its influence and deposits the washed ores in a suitable receptacle. This is effected by depositing the ores on an endless band of painted cloth, on which are fastened cross pieces of wood to retain the heavier metallic particles, while the lighter are washed away. The edges of the cloth are bound with ropes, which serve as ledges to retain the materials on the endless band.

[Printed, 6*d*. See Repertory of Arts, vol. 5 (*enlarged series*), p. 362; London Journal (*Newton's*), vol. 28 (*conjoined series*), p. 194; Mechanics' Magazine, vol. 43, p. 57; and Engineers and Architects' Journal, vol. 8, p. 171.]

A.D. 1844, November 23.—N° 10,399.

SPENCER, John.—" Improvements in manufacturing or pre- " paring plates of iron or other metal for roofing," &c. The plates of metal are corrugated by passing them through fluted rollers, and bent into an arched form, when requisite, by passing them between a grooved roller and two plain rollers placed below it, as shown in the drawings.

[Printed, 6*d*.]

A.D. 1844, December 12.—N° 10,429.

MALINS, William.—Improvements in iron roofs, and preparation of the materials thereof.

No Specification was enrolled.

A.D. 1844, December 18.—N° 10,441.

WALL, Arthur.—" Improvements in the manufacture of steel, " copper, and other metals."

An ordinary converting furnace is employed, and the bars of iron intended to be converted into steel are embedded in charcoal or other carbonaceous matter, or in a mixture of 6 parts of charcoal to 3 parts of chalk, with the addition of 2 lbs. of zinc filings to one bushel of the mixture. The mixture is spread on the bottom of the converting furnace or heated in a separate retort, and "the carbonic oxide thus generated is directed upon the "chamber in which the iron is under process of conversion" until it is completed. Electric currents are then to be passed through the bars, being continued for a period of twelve or fourteen hours or more. Electric currents are also to be transmitted through steel, copper, or other metals while they are in the melted state, and in the process of solidification in the way described, or by any other convenient method and apparatus.

[Printed, 7*d.* See Repertory of Arts, vol. 6 (*enlarged series*), p. 348; London Journal (*Newton's*), vol. 27 (*conjoined series*), p. 29; Mechanics' Magazine, vol. 42, p. 443; Artizan, vol. 5, p. 256; Patent Journal, vol. 3, p. 459; and Engineers and Architects' Journal, vol. 8, p. 226.]

A.D. 1845, January 16.—N° 10,470.

OSBORNE, JOHN JAMES.—"Improvements in the manufacture of iron and steel, and in furnaces to be employed in such and similar manufactures."

To improve the quality of the iron, "a mixture composed of 2 lbs. of common salt, 2 lbs. of fresh burnt or quick lime in powder, and 15 lbs. of iron scabs" or hammer slag is introduced into the puddling furnace in small quantities at a time, and melted up with the charge of about 3 or 4 cwt. of pig iron. The iron is then puddled and made into bar iron. "For making shear steel," to a charge of 5 cwt. of pig iron, 20 lbs. of hammer slag are added while the iron is liquid, and, subsequently, a mixture of "2 lbs. of common salt, 2 lbs. of quick lime in powder, and 2 lbs. of pearlash, or 4 lbs. of the common carbonate of soda" (the former is preferred) should be added in small quantities. A violent effervescence ensues, and the mass, when worked, is made in the ordinary way into sheer steel. When cast steel is required, the mass is similarly treated with the mixture, but not puddled or balled; or a blast furnace may be employed. The charge is run out in a plate of about 1½ inch thickness. It is cooled with water, the slag is removed, and then the mass is broken up, and melted in crucibles. "28 lbs. of the plate, with 1½ lb. of green bottle glass, 8 oz. of pearlash, or 16 of carbonate of soda" and "8 oz. of black oxide of manganese" will produce excellent cast steel. The improved furnace has for the body an iron pot about 2½ feet high, 3 feet in diameter, with 8 holes for the blast, lined with fire-clay, having a stand or stands to support the crucible, and a cover, so that the whole forms an air-tight chamber. The pot is placed within an iron casing, leaving a space of about 3 inches between the pot and the casing, which acts as an air chamber. The blast is admitted through two or more openings in the casing, and then passes through the 8 holes in the interior pot, which are so placed as to distribute the blast equally.

[Printed, 6*d.* See London Journal (*Newton's*), vol. 27 (*enlarged series*), p. 94; and Engineers and Architects' Journal, vol. 8, p. 331.]

A.D. 1845, January 16.—N° 10,475.

BUDD, James Palmer.—" Improvements in the manufacture of iron."

The heat, flames, and gases of the blast furnace are applied to heat air for the hot blast, by making convenient lateral openings in the furnace, so that the flame may pass out laterally into an adjacent heating chamber, which it is recommended should be placed near the tunnel head. The chamber contains the usual pipes or suitable heating apparatus, and the flame is urged through it by the draft of a chimney or other means, which may be regulated by a door acting as a damper.

[Printed, 3*d.* See Mechanics' Magazine, vol. 55, p. 178; Practical Mechanics' Journal, vol. 4, p. 204; and Patent Journal, vol. 11, p. 221.]

A.D. 1845, April 7.—N° 10,590.

NEWTON, Alfred Vincent.—" Improvements in machinery " or apparatus for forging and stamping metals," &c. A communication.

Apparatus is described for working a vertical hammer, or stamper or chipping tool for dressing stones.

[Printed, 10*d.* See London Journal (*Newton's*), vol. 27 (*conjoined series*), p. 423.]

A.D. 1845, April 15.—N° 10,614.

TAYLOR, John.—" Improvements in separating metals," &c. The invention relates exclusively to separating silver from the ores or metallic combinations containing it.

[Printed, 4*d.*]

A.D. 1845, May 3.—N° 10,651.

ATWOOD, Charles.—" Improvements in manufacturing iron."

No Specification was enrolled.

bars with heads, or having increased breadths forming one entire piece to obviate the disadvantages of welding, the bars being intended for suspension bridges and other purposes.

[Printed, 6*d.*]

A.D. 1845, October 9.—Nº 10,857.

MOREWOOD, EDMUND, and ROGERS, GEORGE.—" Improvements in the manufacture of iron into sheets, plates, or other forms in coating iron," &c.

The invention relates to modes of making corrugated sheets of wrought iron, indenting plates, and coating iron with copper or alloys of copper.

[Printed, 9*d.*]

A.D. 1845, October 10.—Nº 10,871.

JAMIESON, ALEXANDER, and LUNDHOLME, JOHN FREDERICK.—Improvements in dressing ores requiring washing apparatus is described for washing ores by " successive mechanical agitations in water," and also for drying the washing ores by the application of pressure.

[Printed, 1*s.* 1*d.* See Patent Journal, vol. 4, p. 501.]

A.D. 1845, November 4.—Nº 10,921.

SANDERSON, CHARLES.—" Improvements in combining steel and iron into bars for tyres for wheels, and for other purposes."

Blooms of iron are made with cavities or grooves in their sides of the required form and size, and in the position where it is requisite that the steel should be united to the iron. A small strip of iron is then welded on the face or open side of the bloom, forming with the bloom a tubular cavity; into this the melted steel is poured, and so is united with the iron. In covering pieces of iron of a circular form, as for piston rods and other pieces, a bloom of iron of the requisite shape is surrounded with an outer tube of thin iron, the space between the outer tube and the bloom being such as will give the requisite thickness of steel. Into this space the steel is poured, so as to unite with the bloom, and the outside face of iron is afterwards removed by grinding or turning. An ordinary furnace may be used for melting the steel, but a blast furnace described is preferred. The blocks of combined iron and steel are placed in a common reverberatory furnace, and gradually heated to a welding heat, when they are withdrawn, and a perfect weld or union of the two metals is obtained, either by the hammering or, by preference, by passing the block through rollers, or under a powerful press or squeezer, so as to weld and give the bloom the required shape.

[Printed, 7*d*. See Repertory of Arts, vol. 7 (*enlarged series*), p. 349; and Engineers and Architects' Journal, vol. 9, p. 186.]

A.D. 1845, November 18.—N° 10,953.

MALINS, WILLIAM.—" Improvements in constructing roofs and " other parts of buildings of iron or other materials, and in the " preparation of the materials of which the same are or may be " constructed." The improvements consist in making the plates of a certain shape so as to overlap, and making the rafters hollow and fastening the plates by staples or screw bolts, &c., as described.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 30 (*conjoined series*), p. 425.]

A.D. 1845, November 27.—N° 10,971.

POOLE, MOSES.—" Improvements to hinder the oxidation of " iron in all its various states, cast metal, steel, and malleable " iron, and also to render malleable iron more hard and durable." A communication from abroad.

1st. Tin, copper, nickel, or antimony, may be mixed with the iron in various proportions from 2 to 10 per cent.

2nd. Malleable iron is coated with the above mixture of metals. The proportions of the metals compounded in the mixture must depend upon the use to which the iron is intended to be applied; and the mixture is to be tested with an iron rod to see if it resists corrosion. Manganese may also be used beneficially.

3rd. A process of case hardening is described in which ferrocyanides of sodium, calcium, or barium, carbonate of soda, and various alkaline salts and earths are employed.

[Printed, 4*d*. See Repertory of Arts, vol. 9 (*enlarged series*), p. 36; and Patent Journal, vol. 1, p. 43.]

A.D. 1845, December 4.—N° 10,976.

GOSSAGE, WILLIAM.—" Improvements in obtaining products " from certain ores, and other compounds of certain metals."

These relate to modes of obtaining products from sulphureous ores and compounds of copper, zinc, lead, or iron.

[Printed, 5*d.*]

A.D. 1845, December 10.—N° 10,997.

MUSHET, William, and MUSHET, Robert.—" Improve-" ments in moulding iron." Mechanical means or apparatus, such as rollers, pressers, stampers, &c., are employed, instead of hand labour, in pressing down the loam or sand in the moulding box.

[Printed, 6*d.* See Repertory of Arts, vol. 8 (*enlarged series*), p. 9; Patent Journal, vol. 1, p. 58; and Engineers and Architects' Journal, vol. 9, p. 246.]

A.D. 1846, January 31.—N° 11,065.

BOVILL, George Hinton.—Improvements in the manufacture of iron. The invention relates,—

1st. To an arrangement of apparatus for heating the blast by the flames at the tunnel head of the furnace, consisting of narrow and deep chambers, so that the air is heated in thin sheets.

2nd. To " an improved mode of heating the air or blast, by " blowing the same partly through and partly over the fire in a " closed retort or fireproof chamber."

3rd. " To the working of blast furnaces by exhaustion or " suction, in contradistinction to the present method of blowing " air into them at a greater pressure than the atmosphere."

4th. " To the introduction of steam above the boshes of blast " furnaces."

5th. To a method of puddling iron " by the application of the " water furnace, commonly known as Kymer and Lighton's fur-" nace, the same being worked by air blown into a closed ashpit, " and the introduction of air over the fire to consume the gases " generated."

6th. To a preparation of cinder from Cumberland ore or hammer scale, and the slack of anthracite coal or other suitable fuel, " to " assist the working of iron in the puddling furnace," and also to facilitate the combination of steel with iron.

7th. To " a mode of calcining iron by combining the use of " certain furnaces with heaps of ore."

8th. To a mode of constructing certain furnaces for heating or reheating iron, the heat and flame being made to descend through the bed of the furnace.

[Printed, 8*d.* See Patent Journal, vol. 1, p. 179.]

A.D. 1846, February 11.—N° 11,078.

BUDD, James Palmer.—“ Improvements in the manufacture “ of iron.” These relate to “ the application of clinkers arising from “ the combustion of coal in the manufacture of iron.” Clinkers being of a light porous nature and containing earthy matters are combined in the blast furnace with the rich ores or iron cinders. They “lessen the density of the whole,” allow a “ a freer passage “ for the blast,” and supply the “ necessary proportion of earthy “ matter.” Where the clinkers are rich in iron a less proportion is employed than where they are poor. Ironstone cinders and mine are combined with the clinkers in such proportions “ as to retain “ the per centage of the iron in the charge fed into the blast “ furnace below 50 per cent. of iron.” If the clinkers are rich enough in iron they may be used alone.

[Printed, 3*d*. See Patent Journal, vol. 5, p. 393; and Engineers and Architects' Journal, vol. 11, p. 306.]

A.D. 1846, June 29.—N° 11,262.

STIRLING, John Davie Morries.—“ Certain new alloys and “ metallic compounds, with a method of welding the same and “ other metals.” In order to produce metals having the qualities necessary for various purposes, cast iron is mixed with tin to give hardness, with wrought iron to give tenacity and strength. To obtain closeness of texture and smoothness of surface alloys of tin, bismuth, zinc, and copper are employed, also silver; manganese adds hardness. Particular directions are given as to proportions and method of using the various metals. In welding the metals and alloys the surfaces are to be made very even and smooth, and the metals heated to a low welding heat, as low as possible. Borax or other suitable flux may be applied to the surfaces, and pressure is then applied by means of a screw, vice, rollers, or otherwise. The pressing apparatus should also be heated.

[Printed, 4*d*. See Repertory of Arts, vol. 10 (*enlarged series*), p. 36.]

A.D. 1846, July 14.—N° 11,288.

HILL, Lawrence.—“ Improvements in manufacturing iron for “ building ships,” &c. The invention relates to a mode of forming the outside shell or plating of two layers of malleable iron hoops, and making the heels of plates rivetted together; and also a new *mode of boring* the holes in the plates and bars.

[Printed, 8*d*. See Repertory of Arts, vol. 9 (*enlarged series*), p. 212; and Patent Journal, vol. 2, p. 572.]

A.D. 1846, July 14.—N° 11,296.

STEWART, David Yoolow. — " Improvements in moulding " iron and brass." The invention relates to a mode of moulding pipes and cylinders, in which the labour of ramming the sand is saved and great accuracy is obtained.

[Printed, 7*d.* See Repertory of Arts, vol. 9 (*enlarged series*), p. 155; Patent Journal, vol. 2, p. 587; and Engineers and Architects' Journal, vol. 10, p. 122.]

A.D. 1846, August 4.—N° 11,322.

PAYNE, Thomas. — " Improvements in the manufacture of " rolls for rolling iron and other metals." The rolls are made by casting them of the proper size, leaving the interiors hollow. Wrought-iron axes or shafts are then accurately fitted in the hollow rolls, and fastened with keys or wrought-iron collars shrunk on. The working journals and surfaces are afterwards turned.

[Printed, 3*d.* See Repertory of Arts, vol. 9 (*enlarged series*), p. 174; London Journal (*Newton's*), vol. 30 (*conjoined series*), p. 108; Engineers and Architects' Journal, vol. 10, p. 90; and Patent Journal, vol. 2, p. 623.]

A.D. 1846, September 24.—N° 11,380.

NEWTON, Alfred Vincent.—" Improvements in the method " of heating, hardening, and tempering various articles made of " steel or of iron and steel combined." A communication.

The Specification and drawings describe heating ovens and revolving apparatus to ensure the articles being properly heated; and also apparatus for dipping the articles in the hardening liquid.

[Printed, 10*d.* See London Journal (*Newton's*), vol. 30 (*conjoined series*), p. 332.]

A.D. 1846, October 15.—N° 11,411.

CONDIE, John.—" Improvements in machinery, and in manu- " facturing malleable iron." The invention relates,—

1st, to improvements in steam hammers; and the Patentee distinguishes his invention from the steam hammers of *James Watt, see* Specification of Watt's Patent, N° 1432, *April 28, A.D. 1784* (printed), and of Deverell, see Specification of Patent N° 2939, June 6, 1806 (printed), and of

Nasmyth, see Specification of Patent N° 9382, June 9, 1842 (printed); also Specification of Patent N° 9850, July 24, 1843 (printed); in all of which the steam cylinder is fixed, and the hammer attached to the moveable piston rod whereas the Patentee makes his steam cylinder moveable, and form part of and act as a hammer, the hammer face being applied to the end of the cylinder so as to employ its weight with advantage.

2nd. Anvils, hammer, and squeezer faces are made with wrought-iron tubes therein, so that water may circulate freely through them, and keep them cool.

[Printed, 10*d*. See Repertory of Arts, vol. 9 (*enlarged series*), p. 343; London Journal (*Newton's*), vol. 30 (*conjoined series*), p. 345; Patent Journal, vol. 2, p. 786; and Engineers and Architects' Journal, vol. 10, p. 224.]

A.D. 1846, December 7.—N° 11,476.

MOREWOOD, EDMOND, and ROGERS, GEORGE.—"Improvements in the manufacture of iron into sheets, plates, &c." The invention relates to modes of preparing and coating and stamping sheets of iron and other metals.

[Printed, 9*d*. See Repertory of Arts, vol. 11 (*enlarged series*), p. 169; London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 18; and Patent Journal, vol. 3, p. 50.]

A.D. 1846, December 14.—N° 11,482.

YATES, JAMES.—"Improvements in the construction of blast "furnaces." These relate,—

1st, to an improved furnace wherein an arch or dome is employed, fixed at or below the tunnel head, so as to cause the heat and flames to reverberate against the arched part, and be thrown down upon the charge, so as to heat it sooner and obviate the necessity of the charge remaining very long in the furnace, which the Patentee does not consider beneficial. Several forms of furnaces are described made upon this principle, which are less lofty, and have more tuyeres than those in ordinary use.

2ndly. A tuyere box is described which is kept cool by the passage of air round the pipe instead of employing water.

3rd. An improved arrangement of two or more reciprocating engines and blowing cylinders without a flywheel or beam, by which great uniformity of pressure is said to be obtained.

4th. An air regulator by which the blast is regulated by mes of a flexible cylinder acted upon by the pressure of steam or springs.

5th. Two or more fans are placed on the same axis, the air being driven by one fan into the case of another, and motion being given by a rotatory engine upon the same shaft.

[Printed, 1*s.* 7*d.* See Repertory of Arts, vol. 10 (*enlarged series*), p. 129; Mechanics' Magazine, vol. 47, p. 20; and Patent Journal, vol. 3, p. 103.]

A.D. 1847, February 24.—Nº 11,598.

FOX, CHARLES.—Method of welding or uniting pieces of metal together by pressure.

The pieces of metal are heated to a welding heat, and the surfaces to be welded or united are placed in contact, the pieces of metals being held and supported in suitable moulds. Great pressure is then applied by means of hydraulic presses and suitable apparatus, so as to force together the surfaces placed in contact, and so unite them. Pieces of metal, as iron or steel, are also pressed into various shapes by the hydraulic presses and apparatus described, which may be used for making spokes for railway wheels.

[Printed, 1*s.* 3*d.* See Patent Journal, vol. 3, p. 336.]

A.D. 1847, April 8.—Nº 11,653.

CRANE, PATRICK MOIRE.—" Improvements in the manufacture " of iron." These relate to the use of anthracite coal in the refinery furnace. The anthracite is to be previously heated in kilns or in any convenient manner, or used in a state of ignition. It may be used alone, or mixed with other fuel, and effects saving, and is said to improve the quality of the refined iron.

[Printed, 3*d.* See Repertory of Arts, vol. 10 (*enlarged series*), p. 306; London Journal (*Newton's*), vol. 31 (*conjoined series*), p. 277; and Patent Journal, vol. 3, p. 529.]

A.D. 1847, May 27.—Nº 11,723.

BLEWITT, REGINALD JAMES.—" Improvements in the manu- " facture of malleable iron." The iron, instead of being refined in a refinery furnace, is to be produced from the air furnace commonly used for casting or founding purposes. It is to be melted in the air furnace, and then run out into sand or iron moulds, and then subjected to the puddling process. The fuel used by the Patentee " is a white ash semi-bituminous coal of excellent "quality." He uses 1 or 2 cwt. of charcoal, with each charge of iron of about 4 tons.

[Printed, 3*d*. See Repertory of Arts, vol. 10 (*enlarged series*), p. 354; Mechanics' Magazine, vol. 47, p. 552; Patent Journal, vol. 4, p. 30; and Engineers and Architects' Journal, vol. 11, p. 46.]

A.D. 1847, June 10.—N° 11,738.

DARLING, William.—"Improvements in moulding, and in "the manufacture of certain articles of cast iron." The articles referred to are cast-iron railway chairs, and the Specification and drawings describe the process of casting with cast iron and other moulds, also of annealing the chairs, and of employing iron taken directly from the smelting furnace.

[Printed, 9*d*. See Mechanics' Magazine, vol. 47, p. 605; Practical Mechanics' Journal, vol. 1, p. 15; and Patent Journal, vol. 4, p. 80.]

A.D. 1847, June 19.—N° 11,759.

VICKERS, William.—"Improvements in the manufacture of iron." Pig iron is melted with small quantities of wrought iron, such as scrap turnings or filings, and the mixture is run in finely-divided streams into water. The proportions vary; for making good ordinary wrought iron, 30 parts of wrought-iron turnings, with 70 parts by weight of iron, are found beneficial. If the iron be intended for making steel, the proportion of wrought iron may be increased, and 40 per cent. of wrought iron employed. The melted iron is run into a cast-iron tray, perforated with half-inch holes, and lined with clay about ½ inch thick, punctured "with "holes about ¼ of an inch thick at those places where there are "holes in the tray." The iron is dropped in a divided state into a cistern of water about 15 feet below it, and is afterwards worked up into wrought iron in the ordinary way. From 3 to 5 per cent. of black oxide of manganese may be used advantageously with the melted pig and wrought iron, and may be introduced by placing small quantities in the tuyere holes.

[Printed, 3*d*. See Repertory of Arts, vol. 13 (*enlarged series*), p. 243; London Journal (*Newton's*), vol. 31 (*conjoined series*), p. 427; Mechanics' Magazine, vol. 47, p. 631; and Patent Journal, vol. 4, p. 127.]

A.D. 1847, June 26.—N° 11,767.

WILSON, Robert.—"Improvements in machinery" for forging, *stamping*, and cutting metals, &c. These relate to an improved construction of steam hammer, and the use of steel in forming the metallic packings of the piston, and a method of connecting the rod to the piston.

[Printed, 1*s.* 10*d.*]

A.D. 1847, July 3.—N° 11,781.

BROWN, JEREMIAH.—" Improvements in rolls and machinery " used in the manufacture of iron," &c. These relate to a squeezer by means of which balls of iron are squeezed by subjecting them to the action of three excentric rolls rotating in the same direction. Also to a method of doubling or piling blooms of iron; the blooms are rolled, then cut through, and the two portions are placed on one another and passed through rollers at a welding heat. Also to a method of making vice pins and vice moulds.

[Printed, 1*s.* 4*d.* See Patent Journal, vol. 4, p. 145; and Artizan, vol. 9, p. 153.]

A.D. 1847, July 20.—N° 11,810.

POOLE, MOSES.—" Improvements in the manufacture of cast " metal, iron, and steel."

1st, The quality of cast iron is to be improved by introducing into the liquid metal oxides of iron and of manganese, and nitrates, chlorates, carbonates, and oxides of potassium. Old iron may be used in the proportion of 10 to 50 parts of old iron to 100 parts of oxidizing matters.

2nd. Pieces of cast metal iron may be hardened by using moulds of thin metal, and cooling the external surface thereof.

3rd. Perfectly pure iron may be obtained by the action of zinc on concentrated salts of iron, and is useful for medical and other purposes.

4th. Prussiate and ferrocyanides are used in the manufacture of steel, with 100 parts of iron from 1 to 5 parts of prussiate of potass are employed.

[Printed, 4*d.* See Repertory of Arts, vol. 11 (*enlarged series*), p. 102.]

A.D. 1847, July 23.—N° 11,811.

PERLBACH, HENRY JOSEPH.—" An improved method of unit- *" ing certain metals* and alloys of metals." Pieces of wrought iron *are united to cast* iron by cleansing them well with acid and covering them with a coat of tin; then that portion of the surface of the wrought iron which is to be united to the cast iron is covered with an alloy of 5 parts copper to 95 parts tin. The piece of wrought iron is then placed in a suitable receptacle or mould and melted, cast iron is poured upon its surface covered with the alloy. The same means may be employed for uniting steel and cast iron and other metals. If the pieces be very large the proportion of copper in the alloy should be increased.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 40.]

A.D. 1847, July 29.—N° 11,823.

WITHERELL, George.—"Improvements in manufacturing or "working iron for various useful purposes." A communication from abroad.

The Specification and drawings describe apparatus for twisting the fibres of wrought iron during the process of manufacture into bars instead of allowing them to lie longitudinally. Two pairs of rollers are employed, the first pair rolls and delivers the bar to the second pair; these are carried in a forked frame fixed on a hollow shaft which is made to rotate, so that when the second pair "have "laid hold of the bar" they are carried round by the forked frame, and give the bar "a regular and uniform twist," and afterwards deliver the bar so twisted and rolled through the hollow shaft.

[Printed, 6*d*. See London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 317; and Patent Journal, vol. 4, p. 445.]

A.D. 1847, September 2.—N° 11,851.

DAVY, Henry.—Improvements for separating copper and other metals from their ores. These relate,—

1st, to a mode of heating hot blast. In some cases the pipes are in their hotter parts lined with firebrick dipped in a solution of nitrate of copper, which blackens by heat, and is favourable to radiation. In the cooler parts are placed pieces of copper blackened or reddened by superficial oxidation; or a number of small pipes may be used instead of a large main pipe.

A mode of increasing the amount of surface exposed to the heat is also described, with the aid of drawings.

Other parts of the invention relate to the working of copper ores.

[Printed, 6*d*. See Repertory of Arts, vol. 11 (enlarged series), p. 204; and *Patent* Journal, vol. 4, p. 454.]

A.D. 1847, September 9.—N° 11,858.

ROBERTSON, Joseph Clinton.—" Certain improvements in " the manufacture of metals from their ores." A communication. Electricity is employed to aid in driving off the "volatilizable "matters" and impurities, such as sulphur, arsenic, &c., from ores. " Sulphur, phosphorus, and arsenic, being naturally " electro-negative, are therefore powerfully attracted to the " electro-positive pole of a voltaic battery, and have also their " chemical affinities for metallic bases thereby impaired or sub- " verted, so as to yield more readily to the volatilizing influence " of heat, and pass off in a state of fumes or vapour." The ores may be roasted in a close kiln like a limekiln, having moveable iron bars at the bottom. The ores and fuel are filled in alternate layers. On the top is placed a ring or cross of iron, and iron rods pass down from it, vertically or otherwise, through the mass. When the charge is ignited the cross or ring is to be connected with one pole of a voltaic battery and the bars with the other, and currents of electricity are passed through, their power being proportioned to the mass of materials. As the furnace is emptied at the bottom it is to be replenished at the top, and the calcined or roasted ore is washed and reduced in the ordinary way.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 201; Mechanics' Magazine, vol. 48, p. 260; and Patent Journal, vol. 4, p. 432.]

A.D. 1847, October 14.—N° 11,906.

NEWTON, Alfred Vincent. — " Improved machinery for " blooming iron." A communication. The Specification and drawings describe a " rotating cam-formed compresser, combined " with two or more rollers placed near each other and at the same " distance from the axis of motion of the compresser, so that the " compression and elongation of the loup will be due entirely to " the excentricity of the compresser." On the surface of the rollers are slight projections, and on the periphery of the compresser are teeth gradually diminishing in depth, so as to catch hold of and turn the bloom. Two cheeks are combined with the compresser and rollers, which are curved and forced together by springs, so as to "set up" the ends of the bloom. Apparatus for feeding and discharging the bloom is also attached.

[Printed, 10*d*. See Patent Journal, vol. 4, p. 545; and Engineers and Architects' Journal, vol. 11, p. 170.]

A.D. 1847, October 14.—N° 11,910.

WALL, Arthur.—Apparatus for separating oxides from their compounds. The Specification describes an apparatus in which a series of magnets are made to separate oxides of iron from other oxides and compounds.

[Printed, 9*d*. See Repertory of Arts, vol. 12 (*enlarged series*), p. 32; Patent Journal, vol. 4, p. 528 and Engineers and Architects' Journal, vol. 11, p. 144.]

A.D, 1847, November 16.—N° 11,967.

BRUNTON, William. — "Apparatus for dressing ores or minerals." The Specification describes apparatus for washing ores, in which centrifugal force is applied as a means of separating the heavier from the lighter particles.

[Printed, 10*d*. See Repertory of Arts, vol. 12 (*enlarged series*), p. 45; and London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 427.]

A.D. 1847, November 18.—N° 11,970.

ROCKE, William.—"A new mode of treating and applying "wrought iron." Scrap or pieces of wrought iron are to be melted in a cupola furnace with a weak fan-blast, or in a reverberatory furnace. The molten wrought iron is then cast into the requisite shapes or articles, which are subsequently annealed. They are placed in an ordinary converting furnace in an iron box or casing of bricks and surrounded with rich Cumberland or other ore or charcoal, and covered close to exclude the air, and subjected to heat. A test bar may be used to guide the workman in ascertaining when the operation is completed. Cast iron may be mixed with the wrought iron, if the iron need not be very close and tough, in quantities not exceeding the weight of wrought iron; or steel may be used, in like proportions, if the temper of steel be required in the metal produced.

[Printed, 3*d*. See Repertory of Arts, vol. 12 (*enlarged series*), p. 263; London Journal (*Newton's*), vol. 32 (*conjoined series*), p. 447; and Patent Journal, vol. 5, p. 84.]

A.D. 1847, November 18.—N° 11,971.

PARKES, Alexander.—" Improvements in the manufacture of " metals, and in coating iron and steel."

The invention is described under five heads, the third alone relates to iron, and consists in the use of a flux made up of muriatic acid, 1 cwt.; water, 2 cwt.; charcoal or coal, 2 cwt.; caustic lime or magnesium, limestone or baryta, 4 cwt., either with or without chloride or oxide of manganese, about 20 or 40 parts. To every ton of roasted ore 2 cwt. of this flux are to be added.

If nitrate of baryta, iron, or manganese be used, half the quantity of flux will suffice; if nitric acid be used, 50 lbs. of commercial acid with 100 lbs. of water are added to each ton of wasted ore.

From 10 to 20 per cent. of the above compound may be used in the puddling or remelting furnaces.

[Printed, 4*d*. See Repertory of Arts, vol. 12 (*enlarged series*), p. 191.]

A.D. 1848, January 29.—N° 12,047.

RUSSELL, WILLIAM.—"An improvement in the manufacture of "such bar iron as is used in the manufacture of certain kinds of "rod iron." In order to take off the scale from the bar iron, a scraper or cleanser is fixed in the front of the rolls, which scrapes the bar and removes the scale which would otherwise have to be burned off in the billet furnace.

[Printed, 6*d*. See London Journal (*Newton's*), vol. 33 (*conjoined series*), p. 339; and Patent Journal, vol. 5, p. 233.]

A.D. 1848, February 23.—N° 12,074.

NASMYTH, JAMES, and GASKELL, HOLBROOK.—"Improvements in machinery or apparatus for forging, stamping, and "cutting iron and other substances."

The Specification and drawings describe, under eight heads, various improvements in the self-acting steam hammer.

[Printed, 1*s*. 1*d*. See Patent Journal, vol. 5, p. 341; and Engineers and Architects' Journal, vol. 11, p. 302.]

A.D. 1848, April 18.—N° 12,128.

ATWOOD, CHARLES.—"Improvements in the manufacture of iron." In order to enable iron ores that are reduced to small pieces to be advantageously used, they are to be mixed with coal of bituminous quality and coked, so that the small or pulverized pieces of ore may be combined with the coal, and so be prevented from "*slipping through*" the fuel, and reaching the bottom without being properly reduced.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 33 (conjoined series), p. 406; and Patent Journal, vol. 6, p. 44.]

A.D. 1848, April 27.—N° 12,142.

PARKES, ALEXANDER.—" Improvements in the manufacture of " metals, and in coating metals." The invention relates to ores of copper, silver, and antimony and other sulphuretted ores, and to coating iron with an alloy of lead and tin and antimony.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 33 (*conjoined series*), p. 332; and Repertory of Arts, vol. 14 (*enlarged series*), p. 19.]

A.D. 1848, June 1.—N° 12,173.

TURTON, THOMAS BURDETT.—" Improvements in machinery " for tending and fitting plates or bars of steel, iron, and other " materials to be used for locomotive engines and carriages, " springs," &c.

The Specification describes apparatus for bending plates or bars of steel into segments by means of rollers or blocks.

[Printed, 10*d*. See Repertory of Arts, vol. 13 (*enlarged series*), p. 69; and Mechanics' Magazine, vol. 49, p. 570.]

A.D. 1848, June 13.—N° 12,184.

CAPPER, CHARLES HENRY.—" Preparing and cleansing minerals," &c.

The Specification describes apparatus for sifting, dressing, and washing crushed minerals.

[Printed, 10*d*. See Mechanics' Magazine, vol. 49, p. 596; and Practical Mechanics' Journal, vol. 1, p. 229.]

A.D. 1848, June 13.—N° 12,186.

HUNT, WILLIAM.—" Improved apparatus to be used in pro- " cesses connected with the manufacture of certain metals and " salts."

The Specification describes a reverberatory furnace having a sloping bed or floor of brickwork between the front of the furnace and the bars. The fire is first kindled on the bars, and then upon the bed is deposited the supply of fuel which is gradually heated by the action of the fire, and is pushed on to the bars as required, by means of rakes; the rakes are made with large heads so as to close the doors in the front of the furnace when they are drawn back and not required for operation.

[Printed, 9*d*. See Mechanics' Magazine, vol. 49, p. 599; Practical Mechanics' Journal, vol. 1, p. 252; and Artizan, vol. 7, p. 108.]

A.D. 1848, June 24.—N° 12,193.

HUNT, WILLIAM.—" Improvements in obtaining metals from certain " compounds," &c. Iron is to be obtained from iron slags by first granulating the slag by melting and running it into water, then mixing it with one fourth of its weight of small coal and placing it in a reverberatory furnace covered with small coal. It is to be exposed to a full red heat for cementation for about 24 hours, and metallic iron is the result. This may be melted in the blast furnace to produce pig iron or "puddled" or washed and worked up with pig or plate iron into wrought iron. The Specification also relates to the manufacture of copper and tin, and of soda.

[Printed, 1*s*. 6*d*. See Repertory of Arts, vol. 13 (*enlarged series*), p. 150; Mechanics' Magazine, vol. 49, p. 646; Practical Mechanics' Journal, vol. 1, p. 253; Artizan, vol. 7, p. 130; Patent Journal, vol. 6, p. 124; and Engineers and Architects' Journal, vol. 12, p. 56.]

A.D. 1848, August 8.—N° 12,234.

LEES, SAMUEL.—" Improvements in the manufacture of malleable iron." These relate to the method of forming " the pile or fagot." The plates or " flat bars " are placed at right angles, the corners being dovetailed or overlapping, and the interior is to be filled with best scrap iron, or other plates placed similarly overlapping, or placed vertically or horizontally, as may be found most advantageous for the kind of bar required.

Also to an arrangement and construction of rollers. A suitably formed bar or mould is attached to the framing of the rolling mill so as to preserve the form of the groove or hollow while the bar is passed through the rollers on its edge.

Also two sets of rollers are used revolving in different directions side by side, so that the bar need not be lifted over the rollers.

Also bars of iron are to be straightened after being rolled by fastening them at their ends by two clamps or holders, and allowing them to draw themselves into a straight line by the force of contraction when they cool.

[Printed, 1*s*. 1*d*. See London Journal (*Newton's*), vol. 34 (*conjoined series*), p. 160; Mechanics' Magazine, vol. 49, p. 524; Artizan, vol. 7, p. 156; Patent Journal, vol. 6, p. 205; Engineers and Architects' Journal, vol. 12, p. 82.]

A.D. 1848, August 21.—N° 12,249.

SHAW, RICHARD.—" Improvements in the manufacture of iron into tyre " and other bars, &c. These relate to a mode of arranging the flat bars forming the pile, so that the danger of the bar "laminating" and "shewing joints outwardly" may be avoided. The Patentee makes "hollow shapes and forms by bending plates or "flat bars," and using them in the formation of piles. Care is to be taken that there be no joints on the outer surfaces of these flat plates, the object being "to bring the lamina "of the iron in the pile to correspond and run even with the "shape of the bar into which it is intended to be rolled." The drawings show the different arrangements.

[Printed, 1*s*. 1*d*. See London Journal (*Newton's*), vol. 34 (*conjoined series*), p. 165; Repertory of Arts, vol. 13 (*enlarged series*), p. 277; Mechanics' Magazine, vol. 50, p. 189; Artizan, vol. 7, p. 185; and Patent Journal, vol. 6, p. 207.]

A.D. 1848, September 21.—N° 12,271.

FREARSON, JOHN.—"Improvements in bending or shaping "iron or steel, and other metal." The invention relates to machinery for making the links of chains.

[Printed, 3*s*. 8*d*. See Mechanics' Magazine, vol. 5, p. 286; Artizan, vol. 7, p. 206; Patent Journal, vol. 6, p. 246.]

A.D. 1848, October 12.—N° 12,288.

STIRLING, JOHN DAVIE MORRIES.—"Improvements in the "manufacture of iron and metallic compounds." The patentee, after referring to his Letters Patent of June 29, 1846 (See N° 11,262), describes his improvements in the manufacture of malleable iron and alloys of iron and other metals. 1st, in making malleable iron, he adds malleable iron scrap in proportion of from $\frac{1}{20}$th to $\frac{1}{5}$th, or even $\frac{1}{4}$th by weight to white pig iron in the pig bed, or otherwise, and the mixture is then boiled and puddled so as to thoroughly incorporate the whole together. Another mode of mixing, which is preferred, is to melt the malleable and cast iron in a suitable furnace, and then run the liquid mixture into the puddling furnace; the expense of refining iron is by these processes avoided. If good qualities of cast iron be employed, larger proportions of malleable iron should be used. Refined iron may, if required, be also combined with malleable iron scrap. Steel scrap also improves the quality of the iron. To produce an alloy of malleable iron less fibrous and harder than the common iron, block tin *or groin tin* may be added in proportion of from $\frac{1}{200}$ to $\frac{1}{100}$ *by weight to* any of the above mixtures; bismuth, antimony, and arsenic may be similarly used, and also zinc and copper, which produces a hardening effect, and manganese, which gives a steely character to the iron. An alloy of zinc and iron is produced by introducing zinc into the cupola furnace when the charge has been lately run out; the zinc combines with the iron left adhering to the sides of the furnace, and forms a mixture which should contain from 4 to 5 per cent. of iron; if it be found to contain less more iron should be added. The Specification also describes a method of making an alloy resembling gold from zinc, iron, copper, and manganese, which is called British gold; also an alloy of copper and manganese; also an alloy of zinc, iron, and copper, and nickel, and manganese resembling silver.

[Printed, 5*d*. See Repertory of Arts, vol. 16 (*enlarged series*), p. 42; Artizan, vol. 7. p. 231; Patent Journal, vol. 7, p. 12; Mechanics' Magazine, vol. 50, p. 381.]

A.D. 1848, November 26.—N° 12,310.

NEWTON, Alfred Vincent.—"Improvements in the manu-"facture of steel." The Specification and Drawings describe apparatus and a furnace for refining iron, and forcing upon it currents of gaseous carbon and atmospheric air so as to convert it into steel. The metal is prepared by melting it with a "hot "carbonic oxide blast" in plumbago crucibles.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 35 (*conjoined series*), p. 3; Mechanics' Magazine, vol. 5, p. 428; Patent Journal, vol. 7, p. 38.]

A.D. 1848, November 19.—N° 12,323.

COAD, Richard.—"Improvements in blast furnaces, &c."

No Specification was enrolled.

A.D. 1848, November 11.—N° 12,325.

PARKES, Alexander, and PARKES, Henry.—"Improve-"ments in the manufacture of metals and alloys of metals, &c." These relate to the manufacture of copper and lead, and various alloys of those metals.

[Printed, 4*d*. See Repertory of Arts, vol. 14 (*enlarged series*), p. 96; Mechanics' Magazine, vol. 50, p. 476.]

A.D. 1848, November 29.—N° 12,345.

SCHUNK, Edward.—"Improvements in the manufacture of "malleable iron, and in treating other products obtained in the

" process." The invention consists in manufacturing iron from tin plate, scrap, or refuse, and in separating and recovering the tin. The tinned plate is placed in a boiling solution " of an alka-" line sulphuret containing an excess of sulphur," such as persulphuret of sodium, or in " a solution of oxide of lead in caustic " potash or soda ley," the latter may be used warm or cold, or in " a solution containing a chronate of an alkali and caustic " alkali." The first process is preferred. The scrap iron, after the tin is removed, is to be well washed, and then packed in cylinders or pipes of sheet iron of about a cubic foot capacity. The whole must then be heated to a welding heat, and hammered until it becomes solid. The solution containing the tin is to be boiled down until the residue will crystallize. The crystals are squeezed in a press, and then dried and slowly roasted to drive off the sulphur, leaving an oxide of tin. Upon the oxide of tin is thrown a mixture of small coal, charcoal, or other carbonaceous matter, and dry carbonate of soda or quicklime, and the whole is heated in a furnace until the mass melts, and the tin is run off through a hole in the bottom of the furnace.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 35 (*conjoined series*), p. 15; Mechanics' Magazine, vol. 50, p. 527.]

A.D. 1848, December 16.—N° 12,373.

CLAY, William.—" Improvements in machinery for rolling iron " or other metals," &c. These relate to the use of machinery for rolling taper, conical, or wedge-shaped bars. " The bearings of " one of the compressing rollers are made to rise gradually in " their standards, so that the distance between the rollers is " gradually increased, and a taper form is given to the bar." The Patentee describes a method of effecting this object by means of pistons containing water or other suitable fluid, which is allowed to escape gradually, and allow the pistons to recede.

[Printed, 1*s*. 4*d*. See London Journal (*Newton's*), vol. 35 (*conjoined series*), p. 19; Mechanics' Magazine, vol. 5, p. 597; Artizan, vol. 8, p. 27; Engineers and Architects' Journal, vol. 12, p. 249; Patent Journal, vol. 7, p. 115.]

A.D. 1848, December 30.—N° 12,397.

WILSON, William Gilmour.—" Improvements in the forma-" tion of moulds and cores of moulds for casting iron and other " substances." The Specification and numerous drawings describe the methods of forming the moulds and cores in which collapsing and expanding metal patterns and core bars are employed.

[Printed, 2*s*. 4*d*. See Mechanics' Magazine, vol. 5, p. 20; Patent Journal, vol. 7, p. 160.]

A.D. 1849, January 4.—N° 12,402.

STEWART, DAVID YOOLOW.—" Improvements in the manufacture of moulds and cores for casting iron and other substances." These relate to a mode of making moulds for pipes, and furnishing moulds with wheels to facilitate their being moved into the drying stoves; also to a mode of making cores and core bars, in which vegetable matters, such as sawdust and peat, are employed instead of straw.

[Printed, 1*s*. 2*d*. See Repertory of Arts, vol. 14 (*enlarged series*), p. 129; Mechanics' Magazine, vol. 51, p. 20; Patent Journal, vol. 7, p. 168.

A.D. 1849, January 13.—N° 12,416.

WILLIAMS, GEORGE.—" Improvements in preparing puddling " furnaces used in the manufacture of iron." Iron ore and scoria are ground to powder and mixed with water, so as to form a kind of paste. This is moulded into bricks or slabs or other suitable shapes, dried and baked, and used as a lining for the sides and bottoms of furnaces.

[Printed, 6*d*. See London Journal (*Newton's*), vol. 35 (*conjoined series*), p. 19; Mechanics' Magazine, vol. 51, p. 66; Patent Journal, vol. 7, p. 173.]

A.D. 1849, January 13.—N° 12,418.

DUGDALE, RICHARD.—" Improvements in hardening articles " composed of iron." The articles are enclosed in an air-tight iron box, each article being surrounded with a mixture consisting of charcoal, 1 cwt.; borax, half-a-pound; sal ammoniac, a quarter of a pound, and saltpetre, a quarter of a pound, or, in lieu of the latter, four times the quantity of common salt. The box and its contents are to be exposed for several hours to great heat in a furnace, until experience shall show that the articles have been sufficiently acted upon. They are then to be removed and plunged into cold water. The articles may be hardened only in the parts *required by covering* up the other parts with clay.

[Printed, 3d. See Mechanics' Magazine, vol. 51, p. 66; Patent Journal, *vol. 7, p. 173.]*

A.D. 1849, January 23.—N° 12,437.

PARIS, Charles Henri.—" Improvements in preventing the " oxydation of iron." These consist in coating the iron with glass or vitreous matter.

[Printed, 3*d*. See Repertory of Arts, vol. 15 (*enlarged series*), p. 149; London Journal (*Newton's*), vol. 35, p. 39; Mechanics' Magazine, vol. 51, p. 94; Patent Journal, vol. 7, p. 214.]

A.D. 1849, February 8.—N° 12,457.

HILL, Lawrence.—" Improvements in the manufacture of iron, " and in the machinery for producing the same," a communication from Henry Burden, of Troy, in the United States. The invention consists in working puddlers' balls or heated masses of iron, by rolling and squeezing them into blooms or bars from one end, and by a motion at right angles to the axis of the bloom or bar, so that the mass is gradually reduced and elongated from one end. The balls or blooms of iron are rolled or squeezed between surfaces inclined at an angle to their axes, " so that by the motion of one " or more of these squeezing surfaces at right angles, or nearly so " to the axis of the bar to be produced, the mass of iron shall be " thereby gradually squeezed and reduced and carried towards and " out of the spaces between the said inclined surfaces where they " are nearest together, the mass of iron being thus delivered in a " finished form."

[Printed, 7*d*. See Repertory of Arts, vol. 14 (*enlarged series*), p. 133; Mechanics' Magazine, vol. 51, p. 142; Patent Journal, vol. 7, p. 202.]

A.D. 1849, March 7.—N° 12,508.

BAIRD, James, and WHITELAW, Alexander.—" Improve- " ments in the method or process of manufacturing iron." These consist in a mode of heating air for the hot blast. The heating apparatus, consisting of vertical pipes, having one or more longitudinal partitions or divisions, is fixed at the top of the blast furnace between an internal and external wall. The air driven through these pipes by the blast engine is heated by the flames of the furnace and used as hot blast.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 25 (*conjoined series*), p. 225; Mechanics' Magazine, vol. 51, p. 237; Practical Mechanics' Journal, vol. 2, p. 156.]

A.D. 1849, March 14.—N° 12,509.

SHANKS, Andrew.—" Improved mode of giving form to certain " metals when in a fluid or molten state." The invention consists " in the use of centrifugal force in the forming of metal castings, " whereby pipes, tubes, and cylinders, and also circular-shaped " hollow vessels, may be cast without the use of cores."

In casting tubes and pipes the liquid metal is poured into a hollow cylindrical mould, placed in a horizontal position; the hollow mould is then made to rotate, and the fluid metal is made to spread itself over the inner surface of the mould in an uniform manner; the interior diameter of the mould gives the external diameter of the pipe, and its thickness depends on the quantity of metal poured into the mould.

In casting circular hollow vessels the liquid metal is poured into a cup-shaped hollow mould, fixed in a vertical axis, and made to rotate.

[Printed, *6d.* See London Journal (*Newton's*), vol. 35 (*conjoined series*), p. 175; Mechanics' Magazine, vol. 51, p. 282; Patent Journal, vol. 7, p. 247; Practical Mechanics' Journal, vol. 2, p. 166.]

A.D. 1849, March 19.—N° 12,526.

RUSSELL, Thomas Henry and WOOLRICH, John Stephen.—" Improvements in coating iron, &c." Cadmium and its alloys are used for coating and preserving iron, the cadmium being dissolved in nitric acid diluted with water. Copper and its alloys are also used for coating iron, by employing " soluble acetates and " benzoates with cyanide of potassium."

[Printed, *4d.* See Repertory of Arts, vol. 15 (*enlarged series*), p. 163; Mechanics' Magazine, p. 51, p. 285; Patent Journal, vol. 9, p. 70.]

A.D. 1849, May 26.—N° 12,534.

PARKES, Alexander.—" Improvements in the deposition and " manufacture of certain metals," &c. Iron tubes and other metal articles are coated with any two or more layers of copper, silver, tin, bismuth, or lead, by means of electric agency. In manufacturing copper, lead, and also iron, blowing apparatus is used to force atmospheric air, and also chlorine gas and hydrocarbon gas, upon the surface of the melted metal. In smelting ores of iron two or more blowing machines are attached to the blast furnace to increase the pressure of the air, which is used cold or beated. In working certain metals, and applying them, phosphorus is combined with them, as iron, silver, and nickel, and their alloys. For printing rollers and tubes an iron mould is used for the external form, and a core of sand or loam for the internal form.

[Printed, 6*d*. See Repertory of Arts, vol. 14 (*enlarged series*), p. 361; Mechanics' Magazine, vol. 5, p. 309; Patent Journal, vol. 8, p. 42.]

A.D. 1849, March 26.—N° 12,537.

HENDERSON, David.—" Improvements in the manufacture of " metal castings." The Specification and drawings, which are very numerous, and require to be referred to, describe a series of moulds which the patentee proposes to use for various purposes.

[Printed, 1*s*. 3*d*. See Mechanics' Magazine, vol. 51, p. 308; Practical Mechanics' Journal, vol. 2, p. 185; Patent Journal, vol. 7, p. 262.]

A.D. 1849, July 4.—N° 12,687.

KNOWLES, Sir Francis.—" Improvements in the production " and manufacture of iron." Malleable iron and steel are to be made " from iron ores by a direct process." The iron ores " most " free from earthy matter," and " which approach most nearly to " pure oxides of iron," are selected. They are broken in pieces of small size, so that when lying together interstices are left to allow of the passage of vapour or gases. If necessary, the ores are to be roasted to expel gaseous matter or water. The ores are then placed in air-tight retorts, made of any suitable material, which are heated by a furnace or kiln. Retorts are furnished with gas pipes and stopcocks, so that currents of gas or vapour may be passed through them and their contents, and be cut off as occasion may require. To prevent all danger from explosion when the retorts are charged, a gas jet is lighted in the interior, and allowed to burn until it consumes all the oxygen therein contained. Various kinds of gases may be employed in the process, common coal gas when purified, and carbonic oxide gas, or gas obtained from coal-oil or naptha, or other hydro-carbon properly prepared. These gases are passed in general currents through the contents of the retorts when heated by pressure on the gasometer, or by other convenient means. The hydrogen of the gas " unites with " *the oxygen* of the ore to form water, while the carbon unites " *with* the oxygen to form carbonic acid or carbonic oxide "leaving metallic iron as the result." The process should be carried on until a small portion of carbon is absorbed if malleable iron is to be produced; the gas is then cut off, the contents of the retort taken out and puddled, and worked up into malleable iron. If steel is to be produced, about one per cent. of carbon should be absorbed by the ores in the retorts, the pieces of ore being removed from time to time and tested by the file, or in any other way, to ascertain the stage of the process reached. The ores so charged are then to be melted in crucibles, and made into steel in the ordinary way. If cast iron is to be produced the ordinary ores may be employed, and are to be treated with gas in the retorts until they have absorbed from three to four per cent. of carbon; they are then melted in the blast furnaces with proper fluxes. The common iron ores may also be cemented with carbonaceous matter in the close retorts. In the production of steel certain ores, as pure specular ores, hematites, or spathose ores, are employed, being roasted if necessary, and then cemented in the close retorts, as described; they are then melted in furnaces or cupolas, not more than twenty-five feet high, and very steep in the boshes, and the result is a "steel metal" suitable for ordinary purposes. For superior qualities the steel metal is to be melted in crucibles, and worked up in the ordinary way. If there is a deficiency in carbon this may be corrected by adding pure oxide of iron or iron scales; about one per cent. of carbon ought to be obtained. The gases evolved from the furnaces may be collected at the heads by suitable apparatus, and used for the above purposes. The "spathose iron ores and ores called soft mine" may be used as a flux instead of limestone in blast furnaces, being roasted if requisite, and prepared by the process of cementation described.

[Printed, 10*d*. See Mechanics' Magazine, vol. 52, pp. 25, 45; Artizan, vol. 8, p. 27.]

A.D. 1849, July 18.—Nº 12,705.

HOLLAND, JOHN.—"A new mode of making steel." The chief ingredient employed in the process is "the silkworm cod "or ball, being the remnant of the cocoon with the chrysalis "contained in it," when the silk has been wound off; also all silk waste, remnants, clippings, and bits of old silk may be used, the *same being torrefied* (or highly dried without being carbonised) or not. It is preferred that they should be torrefied and then ground fine to powder to preserve them prom putrefaction. This powder is used for converting bars of iron into steel by covering the burs with layers of the powder and heating in suitable vessels, as in the ordinary cementation process. Iron ores may be converted into steel by melting the ores properly prepared with layers of the silk powder in crucibles.

[Printed 3*d*. See London Journal (*Newton's*), vol. 37 (*conjoined series*), p. 40; Patent Journal, vol. 8, p. 224; Mechanics' Magazine, vol. 52, p. 75.]

A.D. 1849, July 18.—N° 12,706.

PLANT, Reuben.—" Improvements in making bar or wrought iron." The object of the invention is to regulate the heat during the process of puddling iron. A puddling furnace is described having two chambers, a puddling and a preparatory chamber, with a damper between them. Hot or cold blasts of air and jets of steam are used, as described, for regulating the heat in the chambers respectively.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 36 (*conjoined series*), p. 173; Patent Journal, vol. 8, p. 212; Mechanics' Magazine, vol. 52, p. 61.]

A.D. 1849, August 1.—N°. 12,722.

THOMPSON, Benjamin.—" Improvements in the manufacture " of iron." The Specification and drawings describe a furnace in which the current of air is produced by indraught instead of the ordinary method of injection. The gases are withdrawn on the exhaust principle by the use of jets of steam, or a lofty chimney or the archimidean screw. The gaseous products are conducted to a separate steam furnace, and employed for purposes of heating by combustion.

[Printed, 8*d*. See Mechanics' Magazine, vol. 52, p. 119; Patent Journal, vol. 8, p. 221.]

A.D. 1849, August 30.—N° 12,750.

PRIDEAUX, Thomas Symes.—" Improvements in puddling " and other furnaces."

Firstly, a puddling furnace is described having a closed ashpit to which air is supplied under pressure. The air is conducted through pipes or passages regulated by cocks or valves under the bottom of the puddling furnace and through the bridges, so that it becomes heated, and the sides and bottom of the furnace and bridges are cooled. The heated air is thus forced into the closed ashpit, and introduced into the furnace, or it may be introduced through openings in the sides of the furnace.

Secondly, a smelting furnace is described, having a fireplace in the front, and behind that a kind of crucible; and behind that a smelting chamber into which the ore is introduced through a hopper. The smelting chamber communicates with a chimney. Air is forced through suitable passages formed in the brickwork of the lower part of the furnace, and is supplied in a heated state, and under pressure, to a closed ashpit, and thence introduced into the furnace.

[Printed, 10*d.* See Repertory of Arts, vol. 16 (*enlarged series*), p. 25; Mechanics' Magazine, vol. 52, p. 194; Patent Journal, vol. 8, p. 270.]

A.D. 1849, September 6.—N° 12,757.

HEATH, Josiah Marshall.—"Improvements in the manufacture of steel."

These consist "in causing the iron in the granular form in "which it comes from the cementing process" to be mixed "with "manganese and carbon; then brought to a welding heat, and "made into bars" suitable for conversion, and "subjecting them "to the converting process." The iron is to be obtained from the purest ores or oxides, and the carbon used may "be coal tar, or "other cheap hydrocarbon." From 1 to 3 lbs. of oxide of manganese with 1 to 2 gallons of coal tar may be mixed with each 100 lbs. of iron.

[Printed, 3*d.* See Repertory of Arts, vol. 15 *enlarged series*), p. 291; London Journal (*Newton's*), vol. 37 (*conjoined series*), p. 257; Mechanics' Magazine, vol. 52, p. 196; Practical Mechanics' Journal, vol. 3, p. 70; Patent Journal, vol. 8, p. 285.]

A.D. 1849, November 24.—N° 12,861.

COWPER, Charles.—"Improvements in forging iron for "plates, bars, shafts, axles, tyres, cannons, anchors, &c." These consist in employing bars whose sections are trapeziums in forming the pile or fagot, instead of rectangular bars. The shapes of the sections and positions of the joints are adapted to the special objects to be constructed.

[Printed, 1. 2d. See Mechanics' Magazine, vol. 52, p. 437; Patent Journal, *vol. 9, p. 106.]*

A.D. 1849, December 15.—N° 12,895.

DALTON, ALFRED.—"Improvements in reverberatory and other furnaces." In constructing the fireplaces of furnaces, the holes or orifices in the sides through which streams of air are admitted are recessed or set back, to prevent their being choked with falling melted matter. Perforated plates of iron and iron bars are preferred for the sides of furnaces, and special arrangements of flues are described.

[Printed, 9*d.* See Repertory of Arts, vol. 16 (*enlarged series*), p. 329; London Journal (*Newton's*), vol. 37 (*conjoined series*), p. 23; Mechanics' Magazine, vol. 52, p. 493.]

A.D. 1850, January 29.—N° 12,950.

RIEPE, EWALD.—"Improvements in the manufacture of steel." These consist, firstly, in a peculiar manner of working the puddling furnace. A charge of about 280 lbs. of pig iron is introduced and raised to a red heat, when the fluid begins to melt the damper is partially closed to lower and regulate the heat. 12 or 16 shovels-full of slag or cinder iron are then added, and the whole melted down. The mass is then puddled with a little black oxide of manganese, common salt, and dry clay ground together. After the mixture has been acted on for some minutes the damper is fully opened, and 40 pounds of pig iron (or if the ore be sparry iron ore, 20 lbs.) are added, and melted with the charge at a cherry-red heat; as to this part of the process minute directions are given.

Secondly, pig or alloys of pig and wrought iron are cast into thin bars ¼ to ¾ inch in thickness, these are enveloped carefully in best plastic clay and heated in a furnace for from 1 to 3 days until they are converted into steel. A suitable furnace is described for this process.

Thirdly, the iron bars cast as above described are placed in a cylinder made of fireproof stones so as to allow a stream of atmospheric air to pass through and touch freely all the bars. The cylinder is bricked up at the end, as described, and the bars heated until they are converted into steel.

[Printed, 7*d.* See Repertory of Arts, vol. 16 (enlarged series), p. 222; *London Journal* (*Newton's*), vol. 37 (conjoined series), p. 175; Mechanics' *Magazine, vol. 53*, p. 98.]

A.D. 1850, March 19.—N° 13,008.

HORSFALL, William Joseph and Thomas James.—"Im-"provements in the rolling of iron and other metals." Bars, strips, or sheets of metal are passed between rolling surfaces set at an angle to each other, and afterwards through others which are parallel. The strip is thereby made to assume a curved shape, which is bent round into a hoop and welded by the apparatus described, forming a conical hoop suited for tyres.

[Printed, 10*d.* See London Journal (*Newton's*), vol. 38 (*conjoined series*), p. 237; Mechanics' Magazine, vol. 53, p. 254; Patent Journal, vol. 9, p. 297.]

A.D. 1850, March 26.—N° 13,028.

WALKER, Thomas.—"Improvements in the manufacture of "sheets or plates of iron." The plates of iron are such as are used, first, for bridge or boiler plates; secondly, for links of chains of suspension bridges. The plates are passed through rollers having a reversing motion, so that the plates may be immediately passed and repassed in opposite directions. They are cut while hot into the required shape by circular saws, and so are finished at one heating. For links of chains the fagot of iron is hammered into a mould of the requisite shape, and then passed and repassed through the rollers, and are so finished at one heating.

[Printed, 1*s.* 1*d.* See Mechanics' Magazine, vol. 53, p. 276; Patent Journal, vol. 10, p. 5.]

A.D. 1850, June 11.—N° 13,118.

PARKES, Alexander. — "Improvements in smelting and "treating metals, and in the construction of furnaces." The invention relates, 1st, to the working of copper; 2nd, to silver and lead; 3rd, to the manufacture of fire-bricks from crushed siliceous stones mixed wet with slaked lime or ground sulphate of baryta; 4thly, the better combustion of anthracite or stone coal is to be promoted by the use of very fine jets of steam introduced into a furnace from below by perforated pipes laid parallel with the bars of the fire-grate, and having orifices in them the thirty-secondth of an inch in diameter, and about six inches apart, from whence small jets of steam are injected among the burning fuel.

[Printed, 10*d.* See Repertory of Arts, vol. 17 (*enlarged series*), p. 70; London Journal (*Newton's*), vol. 40 (*conjoined series*), p. 436; Mechanics' Magazine, vol. 53, p. 496.]

A.D. 1850, June 19.—N° 13,140.

HEATH, Robert, and Thomas Richard HANDLEY.—" Improvements in the manufacture of iron." These consist in the use of two rollers for rolling and squeezing blooms of iron. Both rollers revolve in the same direction, but one at a greater speed than the other, to give torsion to the bloom at the same time that it is squeezed by the rollers. A projecting piece or "upsetter," connected with a weighted lever, is attached to the apparatus to give a regular figure to the ends of the bloom; or a piston, acted upon by the pressure of steam, air, or water may be used for a similar purpose.

[Printed, 6*d*. See London Journal (*Newton's*), vol. 38 (*conjoined series*), p. 168; Mechanics' Magazine, vol. 53, p. 516; Patent Journal, vol. 10, p. 175.]

A.D. 1850, August 22.—N° 13,230.

DICK, William.—" Improvements in the manufacture of steel and gas." Common fire-clay gas retorts are used. The bottom of the retort is covered with a layer of coal, then a layer of the iron bars to be cemented is placed thereon, and the retort is charged and gas is made in the usual way. Fresh supplies of coal are added as required, at intervals, to make the gas. The bars are allowed to remain undisturbed until the process of cementation is completed, as may be tested in the ordinary way, by withdrawing one of the bars, cooling it suddenly, and breaking it to examine the fracture.

[Printed, 3*d*. See Repertory of Arts, vol. 17 (*enlarged series*), p. 163; London Journal (*Newton's*), vol. 38 (*conjoined series*), p. 267; Mechanics' Magazine, vol. 54, p. 177.]

A.D. 1850, September 5.—N° 13,245.

BARCLAY, Andrew.—" Improvements in the smelting of iron " and other ores, and in the manufacture or working of iron and " other metals, and in certain rotary engines, engines and fans, " machinery or apparatus, as connected therewith."

The Specification and drawings describe a smelting furnace provided with a system of single and compound tuyeres for injecting the blast at different points and levels in the furnace, also with openings in the lower part for the introduction of the fuel; heating chambers are attached to the furnace, so that the fuel is introduced in a highly heated state. An escape valve is employed for the discharge of gases and vapours from the raw coal supplied at the bottom of the furnace.

The ores may be smelted by two operations; either by passing the ores through two furnaces, or in one furnace, by the use of systems of upper and lower tuyeres, as described and shown in the drawings.

A steam blower is described, in which the pressure of the steam is employed directly to expel the air from the cylinders or receivers.

A rotatory engine, on the emission or reaction principle, is also described; and also a fan, having double angular blades.

[Printed, 1*s.* 10*d.* See Mechanics' Magazine, vol. 54, p. 215; Patent Journal, vol. 11, p. 26.]

A.D. 1850, September 26.—N° 13,262.

HOULDSWORTH, Henry.—" Improvements in the manufacture of iron and other metals." A blast furnace is described, having pipes, or channels, or flues, for conveying the escaping inflammable gases to kilns, or ovens, or stoves, where they are applied by combustion to calcining ores or limestone, or to drying cores or moulds.

A kind of compound tuyere is also described, having a division by which the effluent currents of air is separated into two parts. The two currents are made to "impinge on one another and result " in a broad sheet," or they impinge upon " a fixed deflecting sur- " face," or an annular tuyere is employed for similarly spreading or diffusing the blast, in which state the blast is said to be most efficient.

[Printed, 1*s.* 4*d.* See Mechanics' Magazine, vol. 56, p. 277; Practical Mechanics' Journal, vol. 3, p. 278, and vol. 5, p. 4; Patent Journal, vol. 11, p. 5.]

A.D. 1850, September 28.—N° 13,265.

HARRATT, Charles.—" Improvements in rolling iron." Iron bars are twisted in coils or wound round each other, forming a fagot with the grain laid in various directions, which is then rolled into a bar, which is said to be of superior strength and toughness.

[Printed, 2s. See Repertory of Arts, vol. 17 (enlarged series), p. 260; *London Journal (Newton's)*, vol. 38 (conjoined series), p. 345; Patent *Journal, vol. 11, p. 11.]*

A.D. 1850, November 2.—Nº 13,303.

HODGKINSON, Matthew.—"Improvements in furnaces or "apparatus for smelting ores and minerals, and for the making of "pig iron." A blast furnace of peculiar sloping construction is described, having "an inclined floor, on which the charge of fuel "and other materials is supported while under the action of the "fire," instead of placing them, as in the ordinary upright furnace, in a high mass. An inspection of the drawings will be requisite, in order to understand the details of this invention.

[Printed, 9*d*. See London Journal (*Newton's*), vol. 39 (*conjoined series*), p. 63; Mechanics' Magazine, vol. 54, p. 379; Patent Journal, vol. 11, p. 60.]

A.D. 1850, December 5.—Nº 13,385.

RIEPE, Ewald.—"Improvements in refining steel." Bars of raw or puddled steel are placed in a furnace similar to the ordinary puddling furnace but having the bed lower and the grate from 2 to 4 feet below the level of the fire bridge; the door of the ash-pit is air-tight. When the furnace is at full heat the bars are placed therein, and kept separate without touching each other; the door is luted with clay to exclude the air, and the heat carefully regulated by the damper to keep it just below the melting point of steel. To ensure this the flame is watched through an eye-hole in the working door, and "as long as it keeps of a dull or hardly "red colour, the heat will not be in excess." About 1000 lbs. of the bars are put into a furnace of the ordinary size, and kept there for about 4 hours; by this means "carburetted hydrogen "and oxide of carbon are developed in the furnace in abundance;" oxygen from the atmosphere is excluded, and "steel of a very fine "uniform grain is the result."

[Printed, 3*d*. See London Journal (*Newton's*), vol. 39 (*conjoined series*), p. 153; Mechanics' Magazine, vol. 54, p. 476.]

A.D. 1851, January 31.—Nº 13,480.

JOHNSON, Richard.—"Improvements in annealing articles of "iron," &c. These consist in the use of annealing pots or ovens having within them one or more flues. They are specially applicable for receiving wire and other articles requiring to be similarly annealed.

[Printed, 10*d*. See London Journal (*Newton's*), vol. 40 (*conjoined series*), p. 462; Mechanics' Magazine, vol. 55, p. 119; Patent Journal, vol. 11, p. 220.]

A.D. 1851, January 31.—N° 13,486.

STIRLING, John Davie Morries.—"Improvements in the "manufacture of metallic sheets in coating metals in metallic "compounds, and in welding." These relate to the use of polished rolls for rolling sheets of iron and other metals preparatory to coating them with tin, zinc, or other metals: also to a process of coating the metal sheets with other metals: also to the use of zinc in sheets or calamine in the form of powder or paste placed between plates or other forms of iron to be welded together, to which borax in small quantities may be added; this process is also serviceable in filing iron.

[Printed, 4*d*. See Repertory of Arts, vol. 18 (*enlarged series*), p. 317; Mechanics' Magazine, vol. 55, pp. 134, 374; Patent Journal, vol. 12, p. 14.]

A.D. 1851, February 7.—N° 13,496.

ONIONS, William.—"Improvements in the manufacture of "steel." These consist in melting certain matters together and running the product into castings directly, and then annealing them. 2 parts by weight of hæmatite ore with 4 parts by weight of common steel, and 94 parts of iron made from Cumberland or other like ores, are placed in a crucible and melted. The metal, instead of being run into ingots, is run at once into moulds of the required shapes. The eastings are then annealed, and are so rendered malleable, when they may be treated in like manner to articles made of ordinary steel. The annealing is carried on in like manner to that resorted to in annealing articles made of cast iron from Cumberland and similar ores, whereby they are rendered malleable. Articles like bars, about an inch square, should be raised to a red heat in 24 hours, and maintained at that heat for about 120 hours, and then gradually cooled. Cast-steel articles so made may be cut or dressed or partially formed and tempered like articles made of ordinary steel.

[Printed, 3*d*. See Repertory of Arts, vol. 18 (*enlarged series*), p. 331; London Journal (*Newton's*), vol. 39 (*conjoined series*), p. 344; Mechanics' Magazine, vol. 55, p. 136; Patent Journal, vol. 11, p. 231.]

A.D. 1851, February 27.—N° 13,535.

ELLIS, Thomas.—"Improvement in apparatus to be employed "in the manufacture of blooms or piles for railway and other "bars or plates of iron." Rolls are employed which rotate first in one direction and then in another, or backwards and forwards, so that the blooms may be passed and repassed without lifting them over the rolls. A crank and rack, or rack and pinion, are employed for this object.

[Printed, 6*d*. See Mechanics' Magazine, vol. 55, p. 197; Patent Journal, vol. 11, p. 27; Practical Mechanics' Journal, vol. 5, p. 3.]

A.D. 1851, March 20.—N° 13,561.

ROBERTSON, ALEXANDER, and GLOVER, JAMES.—" Improvements in the rolling and laminating metals," &c. Rolls are described to which an elastic pressure may be given by means of a spring or by hydraulic pressure, or a dead pressure is given by actuating a screw. Another part of the invention relates to the manufacture of metallic capsules.

[Printed, 10*d*. See Mechanics' Magazine, vol. 55, p. 259; Patent Journal, vol. 12, p. 12.]

A.D. 1851, April 15.—N° 13,592.

COUTANT, ANTOINE VICTOR.—" An improved mode of partially " hardening iron for various purposes." The object of the invention is to remedy the loss from the wear of rails, railway switches, wheels, and other iron surfaces exposed to much friction. This is proposed to be effected by hardening the surfaces of various articles by causing charcoal and heat to act on those parts only which are to be exposed to friction. This is effected by the use of the apparatus described, being " of sufficient capacity, and provided " with adequate appliances for the treatment of pieces of such " magnitude as railway wheels," &c. The apparatus consists of 4 parts.

1st. A circular chamber set over a hearth, the flame from the fire of which circulates round the chamber.

2nd. A circular kiln, from which a number of flues radiate outwards to let the flames circulate round the chamber.

3rd. A moveable cover or dome, to concentrate the heat in the cementing chamber, surmounted by a crane to move the articles.

4th. A peculiar mechanical arrangement of the parts, whereby the cementation is confined to the desired parts without the use of clay, and the depth of the bed of charcoal is varied as required.

[*Printed, 1s.* See Mechanics' Magazine, vol. 55, p. 322.]

A.D. 1851, June 3.—N° 13,655.

HAZLEHURST, Isaac.—"Improvements in the manufacture "of iron." These relate to the puddling process. The iron is puddled in the furnace with a mixture of iron ore and carbonaceous matter, as ground coal, coke, charcoal, or sawdust. When the iron is puddled the damper is to be lowered until the metal begins to thicken, "it is then boiled and kept very hot until it becomes very "thin or liquid." The draught is then "checked until the metal is "brought into a state" ready "to ball." It is then drawn out in convenient size, but "without being balled, and placed in a closed "barrow, or other receptacle" made to exclude external air, and left to cool. It will then be in a spongy or honeycomb state, and is to be crushed or ground by stampers or rollers; the bad or imperfectly-worked iron must be picked out, and as much good iron as will make a bloom is put in a furnace and balled at a low heat, and worked under the hammer or squeezer in the usual way. The iron so made does not require cutting and piling, and is suitable for spades, edge tools, boiler plates, wire, &c. If required to take a polish, the crushed or ground iron should be scoured. The ground iron is also used "for sinking in the charcoal fires, for making iron for conversion into steel," instead of charcoal pig or best scrap iron.

[Printed, 3*d.* See London Journal (*Newton's*), vol. 30 (*conjoined series*), p. 282; Mechanics' Magazine, vol. 55, p. 495; Patent Journal, vol. 12, p. 121.]

A.D. 1851, August 14.—N° 13,716.

DERODE, Aimé Nicolas.—"A certain process for uniting cast "iron to cast iron and other metals, and for uniting metals together." The patentee proposes to use electricity as an agent for effecting his purpose. If one of the metals is in the liquid state as from the furnaces, it is to be united with the other in the solid state without any preparation; if both be solid they must be scoured, and heat is applied in the ordinary way. Electric currents are passed through the heated surfaces to be united, and are said to cause the molecules of the iron to unite more steadily and firmly together.

[Printed, 7*d.* See Mechanics' Magazine, vol. 56, p. 177.]

A.D. 1851, August 14.—N° 13,718.

SKINNER, Thomas.—" Ornamenting surfaces on metal and " other materials." The invention relates to electro-plating, and gilding and ornamenting ivory, &c .

[Printed, 3*d*. See Repertory of Arts, vol. 19, p. 172; London Journal (*Newton's*), vol. 41 (*conjoined series*), p. 354; Mechanics' Magazine, vol. 56, p. 158; Artizan, vol. 10, p. 66.]

A.D. 1857, September 25.—N° 13,755.

WATT, Charles.—" Improvements in separating metals," &c. These relate chiefly to modes of obtaining metals from alkaline earths, in which the agency of electric currents is employed in connection with heat. Metals are also separated from each other by employing divided vessels, and using electricity as an agent.

[Printed, 8*d*. See Repertory of Arts, vol. 19 (*enlarged series*), p. 301; Mechanics' Magazine, vol. 56, p. 277.]

A.D. 1851, October 16.—N° 13,777.

FROMINGS, Thomas Henry.—" Improvements in forge hammers." These consist in an arrangement of parts enabling the hammers to be used with greater economy and facility, especially for smaller articles. " Cams are attached to a revolving shaft to " actuate the cross head affixed to the guide rod of the hammer," and a helical spring is used to increase the force of the hammer.

[Printed, 6*d*. See London Journal (*Newton's*), vol. 41 (*conjoined series*), p. 349; Mechanics' Magazine, vol. 56, p. 321.]

A.D. 1851, October 30.— N° 13,793.

CALVERT, Frederick Crace.—" Improvements in manufac- " turing iron, and in manufacturing and purifying coke." These relate, 1st, to the use of chlorine or hydrochloric acid, chlorides, or hypochlorites in smelting iron, either by introducing chlorine into the blast furnace or bringing it or hydrochloric acid in contact with the ores when being roasted. Chloride of sodium is preferred, but any cheap chloride or hypochlorites will answer. 6 parts of chloride of sodium to 200 parts of other materials forming the charge will be sufficient; the effect is, to remove to a great extent the phosphorus and sulphur with which the sodium unites to form slag. By analyzing the ores the proportions are more accurately obtained. 16 parts of sulphur or 32 parts of phosphorus require respectively about 58 parts of the chloride or hypochlorite to remove them. The same means are applied to manufacturing coke.

[Printed, 6*d.*]

A.D. 1851, November 15.—N° 13,817.

SISCO, Antoine Dominique.—"Improvements in the manu-"facture of chains, and in combining iron with other metals," &c. "Ribbons or filets of iron or steel are employed, of the required "width of the link of the chain;" these are placed one above the other until the requisite thickness is obtained. They are then to be soldered together.

[Printed, 2*s.* 4*d.* See Repertory of Arts, vol. 20 (*enlarged series*), p. 26; Mechanics' Magazine, vol. 56, p. 435; Practical Mechanics' Journal, vol. 4, p. 214; Artizan, vol. 9, p. 263.]

A.D. 1851, December 8.—N° 13,848.

GARDINER, Perry G.—"Improvements in the manufacture of "malleable metals into pipes, hollow shafts, railway wheels, or "other analogous forms which are capable of being dressed, "turned down, or polished in a lathe." In this manufacture swages or dies are used, which, in addition to the ordinary direct pressure (which alone would produce articles liable to fracture), a rotatory pressure is given by means of pairs of suitably shaped dies or swages, "one or both the dies being made to revolve, "and being gradually brought into closer proximity, whereby the "mass of metal which is placed between them to be acted upon is "made to assume the form of the article required to be made."

[Printed, 1*s.* See London Journal (*Newton's*), vol. 41 (*conjoined series*), p. 98; Mechanics' Magazine, vol. 56, p. 498.]

A.D. 1851, December 22.—N° 13,877.

STIRLING, John Davie Morries.—"Certain alloys and "combination of metals." This invention is an improvement on that patented by the inventor on January 31, 1851. See N° 13,486. It relates to coating metals, such as iron, copper, tin, &c., with metals and metallic compounds, as tin, copper, zinc, lead, gold, platinum, &c., and their alloys.

Also in improving the quality of iron by adding chromium, by preference, in the condition of chrome iron, or chromate of iron, in proportions of from $\frac{1}{400}$ to $\frac{1}{800}$ of each puddling charge; or it may be added at an earlier stage than the puddling process. When the iron is particularly cold-short or red-short a chloride is added, and common salt, at the rate of 1½ to 3 lbs. to each charge. The chromate is to be added when the iron is nearly or quite melted, and the softer iron takes more than the harder class.

Also, instead of chromium, baryta or its salts, by preference, the carbonate may be added to iron, 1 lb. of carbonate to each charge in the puddling furnace.

Also carbonate of lime and muriate of soda, in equal proportions, may be advantageously added to the iron; from 2 to 3 lbs. of the mixture being added to the puddling charge.

Also lead or lead ores or oxides of lead may be advantageously added to iron in the blast furnace, together with chlorides common salt by preference. From 1 to 3 lbs. of lead may be added to the ton of iron ore in the blast furnace. When a chloride is used, it may be thrown in with the lead.

Lead, oxides, and other compounds of lead and chloride of sodium may be used in the proportion of from 15 to 20 lbs. for each ton of iron ore, but these quantities may be varied as found suitable in practice.

The iron thus made will be more free from impurities, and better suited for making malleable iron, than ordinary iron.

[Printed, 4*d*. See Repertory of Arts, vol. 21 (*enlarged series*), p. 47; Mechanics' Magazine, vol. 56, p. 518.]

A.D. 1851, December 24.—N° 13,881.

NEWTON, Alfred Vincent.—"Separating metals and sub-"stances of different specific gravities." Apparatus is described suitable for washing and separating copper ores.

[Printed, 10*d*. See Mechanics' Magazine, vol. 57, p. 19.]

A.D. 1851, December 27.—N° 13,883.

STENSON, Joseph.—"Improvements in the manufacture of "iron, and in the steam apparatus used therein," &c. These relate to,—

1st. The use of "iron sand," such as comes from New Zealand, and small iron ore, or "wootz," from India. With each ton of "iron sand" are mixed 1/12 ton of clay, and 1/7 ton calcined lime; with a ton of "wootz," 1/6 ton of clay, and 1/8 ton of calcined lime. The mixture is ground in a mill like a pug-mill, and is thus made plastic, and divided into lumps. Charcoal may be mixed with the materials to secure more porosity.

2nd. Double jet tuyeres, in which the jets cross like "a swallow-tail" gas burner, are used in the blast furnace. To the blast-pipe is attached a feeding hopper, provided with feeding rollers, which feed in small coal or charcoal, which is thus introduced into the furnace with the blast.

3rd. In piling iron the bars are placed in peculiar diagonal and other directions, as shown in the drawings.

4th. The piles are hammered immediately on leaving the mill furnace, by a hammer placed close to its mouth.

5th. An improved construction of boiler is described and shown, having vertical ascending and descending tubes.

[Printed, 9d. See Mechanics' Magazine, vol. 57, pp. 85, 182; also, vol. 58, p. 201.]

A.D. 1852, January 24.—N° 13,913.

JONES, Joseph.—"Improvements in furnaces used in the "manufacture of iron." These consist,—

1st. In the use of water, or other liquid or solution, applied in troughs, fixed near the flue jamb plates, bridge jamb plates, and back wall plates of single puddling, boiling, or heating furnaces, and also in a tank under their bottom plates, for the purpose of cooling and preserving them.

2nd. In similarly applying water to the jamb plates and partitions of double furnaces, also with tanks under the bottom plates.

3rd. In the use of a flue for carrying off the heated air, sparks, &c., from a refinery furnace.

4th. In economizing the heat of a refinery furnace, by passing its heated air through a flue round the steam boiler.

5th. In the use of water in troughs, to cool the doors of furnaces.

6th. In a similar use of water, to cool the slide dampers.

[Printed, 2s. 7d. See Mechanics' Magazine, vol. 57, p. 114.]

A.D. 1852, January 24.—N° 13,914.

STURGES, Richard Ford.—Improvements in "ornamenting "metallic substances." Designs made of wire, sheet metal, lace, or paper, or other material, are placed between the surfaces of the metal to be ornamented. Pressure is then applied by rollers or otherwise, and the pattern of the design is thus impressed on the metallic surfaces.

[Printed, 3*d*. See London Journal (*Newton's*), vol. 41 (*conjoined series*), p. 341; Mechanics' Magazine, vol. 57, p. 116; Practical Mechanics' Journal, vol. 5, p. 135.]

A.D. 1852, February 13.—N° 13,971.

MOREWOOD, Edmund, and ROGERS, George.—Improvements in the manufacture, &c., of metals, &c. The invention relates to modes of coating zinc and other metals; also to making gutters, and pipes of iron, and corrugated sheets of iron or other metals; and to a mode of applying heat.

[Printed, 7*d*. See Repertory of Art, vol. 20 (*enlarged series*), p. 216; Mechanics' Magazine, vol. 57, p. 177.]

A.D. 1852, February 23.—N° 13,987.

BOULTON, Samuel.—"Improvements in the treatment of "metallic ores," &c.

The Specification describes a process of treating sulphate of zinc, and obtaining chloride or muriate of zinc.

[Printed, 3*d*. See Mechanics' Magazine, vol. 57, p. 179.]

A.D. 1852, March 8.—N° 14,013.

CUNNINGHAME, Alexander.—"Improvements in the "treatment and application of slag or the refuse matter of blast "furnaces." Sulphate of alumina and alum may be obtained from slag, by running it, when in a melted state, from the furnace into a water tank, so as to granulate it. It is then treated with sulphuric acid, in a leaden cistern, until decomposed. Sulphate of alumina is then obtained by mixing with water, and evaporation, and alum is produced by adding potash or ammoniacal salts, and crystallization. By treating granulated slag with muriatic acid, alumina, silica, and chloride of calcium may be obtained. The slag may also be employed in the purification of hydroligneous acid instead of lime; also for the decomposition of various salts, as for obtaining muriatic acid and alkali from the muriates of *potash and soda.*

[Printed, 4d. See Mechanics' Magazine, vol. 57, p. 230; Practical Mechanics' Journal, vol. 5, p. 157.]

A.D. 1854, March 8.—N° 14,014.

PIDDING, William.—" Improvements in mining operations, " and in the machinery connected therewith." These relate to apparatus for drilling holes for blasting operations, and to an explosive compound to be used in connection therewith.

[Printed, *7d.* See Mechanics' Magazine, vol. 57, p. 239.]

A.D. 1852, March 24.—N° 14,033.

COLLINS, William Whittaker. —" Improvements in the " manufacture of steel." A communication.

A charge of about 4 cwt. of grey pig iron is "melted in the " puddling furnace in the ordinary way, with a large quantity of " silicate of iron or other metallic oxide." The first period of the boiling process is continued without "stirring or raking the metal," as is ordinarily done. The melted mass is thus left quietly exposed to great heat, "by which means the impurities, less the carbon, " are burned." This process is continued for from 15 to 30 minutes, according to the nature of the iron. The iron will then begin to rise up, and must be then worked vigorously " under the " action of the highest degree of heat," to make it fit, as soon as possible, to be balled up for the hammer or squeezer or rolls.

The product will be pure "close-grained iron," which " either " in the state of milled bars, balled iron, or finished bars, will " unite with facility with various proportions of carbon." They are, therefore, without previous cementation, " melted in crucibles, " with the application of carbonizing substances, by which means " cast steel is produced," of which the degree of hardness "may " be regulated by the application of carbonizing substances in " greater or less quantity."

" A superior quality of cast steel adapted for tools, chisels, &c. " is obtained by melting the said bars with a comparatively large " proportion of carbonizing substances." The product is a highly carbonized brittle cast steel. "This is to be remelted with fresh " parcels of the said iron bars."

[Printed, *3d.* See London Journal (*Newton's*), vol. 41 (*enlarged series*), p. 317; Mechanics' Magazine, vol. 57, p. 279.]

A.D. 1852, March 24.—N° 14,040.

MOREWOOD, Edmund, and ROGERS, George.—" Shaping, coating, and applying sheet metal to building purposes."

Sheets of iron or other metal are to be prepared of unequal thickness, being in alternate parts, first thick, then thin. This is done by means of suitably shaped rollers. The sheets are then corrugated, the thicker portions being, by preference, on the raised part.

[Printed, 7*d*. See Repertory of Arts, vol. 20 (*enlarged series*), p. 292; Mechanics' Magazine, vol. 57, p. 278.]

A.D. 1852, March 31.—N° 14,051.

WINSLOW, JOHN FLACK.—"Improvements in machinery for "blooming iron."

The object of the invention is stated to be to combine the advantages of both hammering and squeezing iron, as done separately the ordinary way, without their disadvantages, which are, that the hammering alone is too expensive, and the squeezers are liable to lap up and knead in cinder and bad material in the bloom. The apparatus described for this object combines the hammering and kneading actions (and is an improvement on Newton's Patent, see N° 11,906) communicated by this Patentee).

A reciprocating hammer is "applied to machinery constructed "on the principle of blooming iron by the pressure of rolling "surfaces."

[Printed, 10*d*. See London Journal (*Newton's*), vol. 42 (*conjoined series*), p. 1; Mechanics' Magazine, vol. 57, p. 318.]

A.D. 1852, April 22.—N° 14,082.

BENTALL, EDWARD HAMMOND and HOWARD, JAMES.—"Improvements in the mode of chilling cast iron." These relate to an improved construction of iron moulds for containing castings, such as ploughshares, and obviating the disadvantages of suddenly cooling them by throwing water upon them.

A current of air or water or other cooling medium is made to circulate through the moulds, and so absorb the heat of the molten metal. When water is employed means are provided for carrying off the steam which may be generated.

[*Printed, 8d.* See London Journal (*Newton's*), vol. 42 (*conjoined series*), *p. 207;* Mechanics' Magazine, vol. 57, p. 364.]

A.D. 1852, May 1.—Nº 14,103.

PARKES, Alexander. — " Improvements in obtaining and " separating metals."

The invention relates to a process of obtaining the precious metals from lead ores, &c.

[Printed, 3*d.* See Repertory of Arts, vol. 21 (*enlarged series*), p. 161, London Journal (*Newton's*), vol. 57, p. 414, and vol. 58, p. 80.]

A.D. 1852, June 12.—Nº 14,167.

BEAUVALLET, Jean Ernest.—" Improvements in the manu" facture of iron and steel." A communication. These consist in heating cast iron "in contact with a metallic oxide (or it may be " a carbonate which will act by reason of its oxide)," and afterwards extending it by hammering or rolling, without the necessity of puddling it. Directions are given as to the way in which the iron is to be cast in bars or sheets, so that the impurities and bubbles may form their ends, and be cut off with the rough ends of the sheets or bars.

For the decarbonization of cast iron protoxide of zinc and calamine are preferred, but oxide of lead may be used. A table of proportions is given. The zinc, if any remain, is to be driven off by heat. When malleable iron is to be made, much of the decarbonizing substances must be employed; when steel is to be made less will be required, but the steel should be cemented with charcoal in the ordinary way, to expel the zinc and equalize carbonization.

[Printed, 4*d.* See Repertory of Arts, vol. 20 (*enlarged series*), p. 363; Mechanics' Magazine, vol. 57, p. 497.]

A.D. 1852, July 6.—Nº 14,198.

ROBERTS, Martyn John.—Improvements in the production of electric currents, &c. applicable to the reduction of ores. The ores to which the electric currents are applicable are copper ores, which are to be treated with nitric or sulphuric acid.

[Printed, 1*s.* 7*d.* See Mechanics' Magazine, vol. 58, pp. 41, 56.]

A.D. 1852, July 15.—Nº 14,225.

RICHARDS, Thomas, and GROSE, Samuel.—" Improve" ments in machinery for reducing and pulverizing ores." The ores are ground or pulverized between two hard surfaces, of a taper form, so that they gradually approach each other, and the space between them is lessened in proportion. The ores are thereby gradually and evenly crushed.

[Printed, 9*d*. See Mechanics' Magazine, vol. 58, pp. 61, 77.]

A.D. 1852, July 16.—N° 14,226.

HUNT, JOHN.—"Machinery for washing and separating ores." Apparatus is described consisting of a box with partitions, and compartments having perforated copper bottoms moved with a jerking motion, suitable for washing and separating ores, as copper, gold, &c.

[Printed, 9*d*. See Mechanics' Magazine, vol. 57, p. 481, and vol. 58, p. 97.]

A.D. 1852, July 29.—N° 14,244.

BELFORD, AUGUST EDWARD LORADOUX.—"Improvements "in the manufacture of sheet iron."

1st. The iron is well rolled, and then cut up into strips about 1 foot wide, and 3 feet long, called "largets," weighing about 14 lbs.

2nd. These are rolled separately about 14 times.

3rd. Four are then rolled together through heavy rollers, and all projections are then cut off.

4th. The sheets are then heated, and passed 9 times between rolls, and reduced to the proper size, about 28 by 56 inches. They are then again heated and rolled, and afterwards reheated and hammered. A number of sheets are then joined in a bundle, and a layer of fine charcoal is laid between each sheet, and encased in sheet iron, and the whole heated, and again hammered with a small hammer. The bundle is opened, and a new one formed of alternately hot and cold sheets, and this is again heated and hammered by a large hammer. The sheets are then annealed. Boiler plate sheets are improved by rolling the heated plates with a layer of fine charcoal between them.

[Printed, 3*d*. See Mechanics' Magazine, vol. 58, p. 136.]

A.D. 1852, July 31.—N° 14,247.

STARKEY, SAMUEL.—"Machinery for washing minerals, and "separating them from other substances." The apparatus described is intended for working the precious metals.

[Printed, 1*s*. 3*d*. See Mechanics' Magazine, vol. 58, p. 158.]

MANUFACTURE

OF

IRON AND STEEL.

PART III.

PATENT LAW AMENDMENT ACT, 1852.

A.D. 1852.

A.D. 1852, October 1.—Nº 48.

MOREWOOD, EDMUND, and ROGERS, GEORGE.—" Improve-" ments in rolling metals." These relate to the employment of two or more pairs of rollers in succession, which revolve at the same or increasing speeds. Bars or sheets of metal are passed through the pairs in succession, and are extended, as required, by the drawing operation of the rollers revolving at an increased speed. Guide beds may be used between the rollers.

The advantages of compressing and drawing are thus obtained, and the fibres of metal are laid in one direction.

[Printed, 2½*d.*]

A.D. 1852, October 1.—Nº 83.

OMMANEY, HENRY MORTLAKE.—" An improved furnace for " melting of metals in crucibles." The furnace is so arranged in compartments that the coke is not brought into direct contact with the crucibles. Three or four chambers are used. One of them is called the crucible chamber, for containing the crucible and metal to be melted, and into it are directed the flues from the other chambers in which the coke is burned, thereby effecting a saving in time, labour, and materials.

[Printed, 2½*d.*]

A.D. 1852, October 1.—Nº 108.

FEARN, THOMAS.—"Improvements in ornamenting metallic "surfaces, and in machinery and apparatus to be employed "therein." The invention relates to a process of impressing designs upon tubes or rollers, or similar cylindrical forms. This is effected by drawing the tube between wheels or discs set in a frame, so that their peripheries, on which are engraved or raised designs, form an aperture, through which the cylinder is drawn while the peripheries of the wheels press upon the surface, and so impress upon it the designs required.

[Printed, 7½*d.*]

A.D. 1852, October 1.—Nº 134.

OMMANEY, HENRY MORTLAKE.—"Improvements in the "manufacture of stamp heads for crushing ores." The stamp head is cast in the usual way. It is then placed in an annealing furnace, and continued there until the metal becomes decarbonized, and is so rendered partially malleable. This process makes stamp heads more tough and durable.

[Printed, 2½*d.*]

A.D. 1852, October 6.—Nº 272.

HILL, JOSEPH.—"A machine for stamping metals and forging "iron and steel." A ram or forge hammer is actuated by a piston "working by atmospheric pressure in a cylinder, within which "cylinder a vacuum is obtained to raise the piston," which is allowed to fall on the admission of the atmosphere. The action is regulated by suitable valves and gearing.

[Printed, 4½*d.*]

A.D. 1852, October 7.—Nº 296.

TRUEMAN, ALFRED.—"Improvements in obtaining copper and "other metals from ores," &c. Oxide ores are acted upon by digesting them in acids, and afterwards applying lime. The process is specially applicable to copper ores.

[Printed, 6½*d.*]

A.D. 1852, October 12.—N° 344.

PERKES, Samuel.—" Improvements in certain apparatuses and " machines for the production and treatment of mineral and other " substances, and part of which are applicable to other useful " purposes." These relate to a boring bar, composed of jointed tubes, which admit water to a chisel point or cutter attached to the bar. Boxed valves are attached to the bottom of the bar to retain the minerals when they are obtained and are required to be examined.

Also to a crushing hammer, fixed in a frame, with a feeding hopper and sieving apparatus attached.

Also to other apparatus suitable for the washing and working up of precious metals.

[Printed, 11½*d.*]

A.D. 1852, October 13.—N° 368.

STEVENS, William Walker.—" Application of gas retorts to " a process for improving iron and converting iron into steel." The application for this Patent was not proceeded with, and a provisional Specification only was deposited. Gas retorts are to be employed in the manufacture of iron and conversion of it into steel at times when unemployed in making gas. Their use is to be thereby economised.

[Printed, 2½*d.*]

A.D. 1852, October 21.—N° 468.

THOMAS, Alexander.—" Improvements in the treating and " welding of metals," &c. The application for this Patent was not proceeded with. The provisional Specification describes the invention as relating to a process of cementing surfaces of steel and iron, and reviving the properties of cast steel by using combinations of borax, sal ammoniac, prussiate of potass, and rosin; also to using gray china, sal ammoniac, gunpowder, soap, and prussiate of potass for hardening steel.

[Printed, 2½*d.*]

A.D. 1852, November 16.—N° 768.

LEA, John Wheeley, and HUNT, William.—" Improve- " ments in utilising the waste heat of coke furnaces." The heat is to be applied in the manufacture of iron by applying it to burning or calcining "iron cinder." A kiln or calcining chamber is built at the back of one or more coke ovens, and the heat from the coke ovens is conducted to the kiln by suitable flues, and employed to burn the charge of cinder. About 21 days will be found sufficient for this object.

[Printed, 6½*d.*]

A.D. 1852, November 17.—N° 772.

BELL, ISAAC LOWTHIAN.—" Improvements in the treatment of " certain compounds of iron and sulphur." The invention relates to a mode of turning to advantage tank residuum or soda makers' waste, and pyrites refuse left from the manufacture of sulphuric acid. Sulphuret of iron is obtained from tank residuum by treating it with oxide of iron, such as burnt pyrites, or pyrites residuum, and by smelting in a blast furnace.

[Printed, 3½*d.*]

A.D. 1852, November 22.—N° 815.

LEA, JOHN WHEELEY, and HUNT, WILLIAM.—" Improvements in the manufacture of iron." These consist in applying the carburetted hydrogen gas obtained from the making of coke to heat the furnaces used in the manufacture of iron. An ordinary gasometer is attached to an ordinary coke oven, or a series of them, and the evolved gases are collected therein, and then distributed by means of pipes and stopcocks to the furnaces, where they are to be consumed. The gases are burned from a perforated pipe or burner, as described, and may be used in connection with coke or coal, or anthracite coal, in an ordinary grate. A puddling furnace, furnished with the requisite gas pipes, is described and shewn in the Drawings.

[Printed, 5½*d.*]

A.D. 1852, November 21.—N° 859.

BENNET, THOMAS.—" Improvements in heating air for blast " furnaces." The application for this Patent was not proceeded with, a provisional Specification only was deposited. This states the invention to consist in rendering a furnace self-supplying with hot blast, the blast being heated in pipes heated by the furnace itself, and passed through them to the tuyere holes.

[Printed, 2½*d.*]

A.D. 1852, November 26.—N° 870.

HOBY, James Ward, and KENNIBURGH, John.—"Im-"provements in the manufacture of metal castings." The improvements are effected by means of moulds made of fire clay either alone or mixed with other substances, as sand or plumbago, which are "baked or burnt previous to use" so as to acquire the nature of brick. The moulds may be made entire or in several pieces carefully fitted, and their faces are made smooth after being burnt by rubbing or grinding them. The surfaces may be washed over with a mixture of plumbago and water, or plumbago and beer or yeast.

[Printed, 5½*d.*]

A.D. 1852, December 2.—N° 930.

DABLE, John, and WELLS, William.—"An improvement in "rolling metals." The rolls are connected with an adjustable apparatus consisting of anti-friction rollers and a slide moving between them and acting on the journals, whereby the distance between the rolls is regulated so as to roll metal varying in its thickness in different parts as required.

[Printed, 5½*d.*]

A.D. 1852, December 16.—N° 1079.

KNOWLES, Sir Francis Charles.—"Improvements in the "manufacture of iron."

These relate to, 1st, the use of slags from copper smelting furnaces in smelting rich iron ores, black bands, or forge cinders, in connection with appropriate fluxes, to form a cinder for the iron while being made.

2d. The use of felspar, both soda and potash felspar, combined or alone, as fluxes for smelting iron ores.

3d. The use of peat, coke, or charcoal to reduce rich iron ores in the common Catalan forge or fire.

4th. Also malleable or bar iron is made direct from the rich ores by crushing them with suitable fluxes to the size of gravel or smaller, and working the ore and fluxes with peat or other charcoal in the puddling furnace.

5th. The gases obtained from the dry distillation or coking of *peat or coal in the* common retorts are used in puddling and balling *furnaces,* The Specification gives accurate proportions for the fluxes and materials to be employed.

[Printed, 3½*d*.]

A.D. 1852, December 22.—N° 1133.

JOHNSON, JOHN HENRY.—" Improvements in machinery or " apparatus for forging iron and other metals." A communication. The Specification and Drawings describe apparatus for holding, carrying forward, and turning a bar or rod of heated iron in such a manner that the action of the hammer and swages may be adapted to the forms required to be given to the various articles.

The hammer is connected by a pin, pivot, or fulcrum to a sliding guide which traverses on side bars, and is allowed to "turn or " vibrate a short distance, when power is applied to it by means of " a crank, cam, or eccentric, and the connecting rods."

The swages are to be of various forms, suited to the shape of the articles to be forged, and their position is adjusted as required.

The holders in which the heated bars are held are supported on a traversing platform.

[Printed, 7½*d*.]

A.D. 1852, December 29.—N° 1193.

BROWN, WILLIAM.—" Improvements in forging, shaping, and " crushing iron," &c. A provisional Specification only was deposited as the Patent was not proceeded with. It contains a description of a steam or pneumatic hammer suitable for forging iron, &c.

[Printed, 2½*d*.]

A.D. 1852, December 31.—N° 1208.

PICKSLAY, WILLIAM MORTON.—An improvement in the blast of furnaces. The application for Letters Patent was not proceeded with, a provisional Specification was deposited, with Drawings attached. The blast is introduced by a blast pipe and tuyere, which are separated by a short space, and form two separate and distinct parts. The mouth of the blast pipe is of smaller diameter than the tuyere, which is placed opposite it, and the smaller column of air issuing from the blast pipe is to impinge on the larger column contained in the tuyere, and so drive a greater volume into the furnace.

[Printed, 4½*d*.]

A.D. 1852, December 31.—N° 1209.

SMITH, THOMAS BENJAMIN.—" Improvements in calcining certain ores, and in the construction of furnaces for that purpose," &c. These apply to the process of smelting, sulphuret, copper, and other ores.

[Printed, 3½d.]

A.D. 1853.

A.D. 1853, January 1.—N° 5.

WATSON, JOSEPH JOHN WILLIAM.—"An improved method "of manufacturing steel and of carburising iron." Electricity is used for "producing carburisation in soft iron to form steel and "carburised iron," whereby common English iron may be as readily converted as finest Swedish iron. The patentee also uses "sulphate of manganese (preferably the waste sulphate from the "chloride of lime stills) with carbonaceous matter and lime to form "steel either with or without the use of an electric current."

[Printed, 3½*d.*]

A.D. 1853. January 15.—N° 102.

BRAMWELL, FREDERICK JOSEPH, and BAGGS, ISHAM.—Improvements in steam machinery used for driving piles, hammering, stamping, and crushing, &c. A steam engine is described combined with suitable apparatus, which may be adapted to the purposes named, as well as for hammering iron. The steam is to be first used on a smaller piston surface, and then expansively on a larger piston surface.

[Printed, 7½*d.*]

A.D. 1853, January 28.—N° 218.

PRIDEAUX, THOMAS SYMES.—"Improvements in the manufac- "ture of iron." The object of the invention is a more advantageous use of coal in the manufacture of iron. "The coal is to be distilled, "as in gas making, to obtain coke and carburetted hydrogen." The coke is used in the blast furnace, and the gas is used in heating the puddling furnace. And in preparing the coke for the blast furnace it is impregnated with alkaline or saline mixtures.

In constructing the reverberatory furnaces, instead of the usual grate an iron box is substituted, which is divided vertically into three divisions, the outer one is connected with a gasometer or reservoir of gas under pressure, the middle one with a similar reservoir of air under pressure; and a series of tubes leads from each of these divisions through the inner chamber into the furnace. The innermost division is supplied with water to prevent the melting of the tubes or tuyeres. This iron box forms the posterior end of the furnace. The surface from the top of the fire bridge to the roof is occupied at regular intervals with the air and gas tubes, each gas tube being surrounded with four or six air tubes. The tubes are supplied with valves, whose handles form indexes to register dials, so that the workman can regulate the supply.

To prepare the coke it is to be cooled by throwing upon it lime water mixed with either common salt or carbonate of soda in the proportion of 2 per cent. to the weight of coke. Instead of these two alkalies "any substance *electro positive* or *basic* towards iron" may be employed, as potassium, sodium, barium, strontium, calcium, &c.

[Printed, 3½*d.*]

A.D. 1853, January 29.—N° 225.

ARCHER, William.—"Improvements in railway signals, parts of which improvements are applicable to blast furnaces." The Specification and Drawings, after describing under six heads the improvements in railway signals, shew how a modification of the means employed for forcing air through the patentee's patent bellows may be employed for furnaces. By using the pressure of a volume of water on the transverse sectional area of his air receiver "a "considerable amount of force may be obtained" for applying his hydro-pneumatic principle to blast furnaces.

[Printed, 6½*d.*]

A.D. 1853, February 2.—N° 283.

BELLFORD, Auguste Edouard Loradoux. — "Improve-"ments in furnaces and apparatus connected therewith for making "wrought iron directly from the ore, and for collecting and con-"densing the oxydes or other substances evaporated in the process "of deoxydizing iron or other ores."—(*A communication*).

1st. A puddling furnace is described having a deoxydizing chamber with upright tubes, and apparatus attached in a vertical position at the back of the furnace. The ores are fed into tubes in the chamber, which are surrounded by the heated waste products issuing from the furnace. They are thus prevented from coming into direct contact with the products of combustion before they are discharged from the heating tubes into the furnace. Suitable apparatus is provided for feeding the ore into the tubes and discharging them thence into the furnace.

2nd. One, two, or more refining fires are combined with a puddling or other similar furnace in such a manner that the products of combustion from the refining fires mix with those of the furnace, and pass with them over the charge upon the hearths of the furnace which is thereby heated. The puddled balls may be thus conveyed directly to the refining fires without taking them from the furnace doors.

3rd. Sparks, dust, and other heavy particles thrown off from the fires are arrested and prevented from being deposited upon or in the charge on the hearth in puddling, reverberatory, and other similar furnaces. This is effected by "sinking the fire chamber "and its roof below its usual position, and uniting the roofs of "the fire chamber and hearth by a vertical or curved ascending "wall, and providing a shelf or space between the fire chamber "and the hearth," so that the particles as they ascend are arrested by the wall and deposited on the shelf, whence they may be withdrawn in any convenient manner.

4th. The escape of the oxides from certain iron ores, as those containing zinc, is provided for by means of "deoxydizing tubes," as described. The sublimates are collected and conducted away, and a hood or cover with suitable openings is placed over the tubes for receiving, leading off, and cooling the sublimates.

[Printed, 1*s.* 9½*d.*]

A.D. 1853, February 5.—N° 326.

PARKES, ALEXANDER.—"Improvements in the separation of "certain metals from their ores or other compounds." Sulphurets with oxides of iron and carbon are used for separating gold and silver from their ores and compounds. To one ton of gold or silver ore 4 cwt. of sulphuret of iron, 2 to 3 cwt. of oxide, and a like weight of carbon are added. The substances after being ground fine and well mixed are fused. The reguline obtained is afterwards treated and refined in the usual way.

[Printed, 3½*d.*]

A.D. 1853, February 12.—N° 373.

PARRY, GEORGE.—"Improvements in blast furnaces." *The application for this Patent was not proceeded with.* A provisional

Specification was deposited, which describes the invention to consist in hanging a skeleton frame, tube, or cage, made of metal bars or perforated plates, in the centre of the blast furnace, thereby keeping the central portion of the furnace unoccupied by the dense charge, and free for the passage of gases and the blast.

[Printed, 2½*d.*]

A.D. 1853, February 15.—N° 426.

DARLING, WILLIAM.—" Improvements in the manufacture of " malleable iron and other metals." Machinery for rolling metals is described, in which an actuating engine works at a higher rate of speed than the rolls, so that a small engine may be employed, driven at a high speed, giving more equal and sufficient rolling at a reduced cost.

2nd. Puddling furnaces are ranged in a semicircular plan, the flues or chimneys from all the furnaces are of uniform length and size, and converge equally into a main chimney stalk, into which the waste steam from the engine is admitted, thereby securing a strong and equal blast. The flues may be conducted over the steam boilers, and their heat thus turned to advantage. The use of moveable furnace bars, such as Bodmer's (see Patent 9899, p. 64.) is recommended for small coal, culm, &c.

[Printed, 6½*d.*]

A.D. 1853, March 3.—N° 537.

COLT, SAMUEL.—" Improved machinery for forging metals." (*Partly a communication.*) A provisional Specification was deposited, but the application for Letters Patent was not proceeded with. It relates to machinery for actuating forge hammers, stampers, &c., which are raised to the required elevation in standards, and guided in their descent by guides, at one blow the heated metal is struck into the required form.

[Printed, 2½*d.*]

A.D. 1853, March 4.—N° 545.

ROSS, ROBERT CRAIB.—" An improved machine or instrument " for cutting files and forging metal." The Specification and Drawings first describe machinery for file cutting; 2nd, a modification of the file-cutting machinery adapted to forging. This consists of a striking lever with a hammer-head, the blow being controlled by the action of a spring, which may be regulated, and be placed on either side of, and at different distances from, the fulcrum. The machine is adapted to turn while striking.

[Printed, 7½*d.*]

A.D. 1853, March 7.—N° 571.

DODDS, THOMAS WEATHERBURN.—"Improvements in the "treatment and manufacture of iron and steel." The improvements relate to the manufacture of iron and steel from the raw material, and to the application of the steeling or case-hardening process to special articles. The raw material or wrought iron is placed in a furnace containing a mixture of carbonaceous matter, as charcoal, and potash, pearlash, or other alkali, and carbonate or bicarbonate of lime, as marble chippings, gypsum, oyster shells, &c.; 10 parts of charcoal, 1 of soda ash, and 2 of lime, being suitable proportions. The furnace is kept at a red heat for about five or six days. A common furnace may be used, but it is preferred to construct a range of retorts, wherein the heat may be uniformly kept up, and the charges withdrawn in succession. The heated metal is then to be plunged in a bath of water impregnated with carbon, or ammoniacal liquor, or prussiate of potash in solution, or in a dry bed of highly carbonized materials, to cool it. To produce a non-oxidizable metal nickel or german silver is incorporated with the iron, $\frac{1}{25}$ to $\frac{4}{25}$ of the mass being added with, in some cases, a small proportion of manganese. In annealing wrought-iron articles, or articles partially steeled or case-hardened, they are placed in a bath or compound mass of carbonate of lime and soda or pearlash or potash. This treatment produces a fine, soft, fibrous metal, and is suitable for the inner non-abrading parts of railway wheels. In steeling or case-hardening iron or a manufactured article, it is placed in a retort charged, as above described, with carbonaceous and alkaline matters and lime. Where fineness or superior polish is required, bone dust or animal charcoal, in proportions of about $\frac{1}{20}$ of the mass, may be added. The articles are kept in the retorts for two hours or longer, according to the depth of steeling or case-hardening required.

The Specification and Drawing also describe apparatus for working steam hammers, wherein the anvil level is adjusted by means of a hydrostatic cylinder or chamber, and the tilt levers are made to strike in both directions by a rotatory crank shaft. An atmospheric buffer is employed to increase the rapidity of the strokes. Cork or other elastic material may be used for a bearing for the anvil.

[Printed, 11½*d.*]

A.D. 1853, March 8.—N° 582.

SCHMITT, Nicolas.—" Improvements in cleansing and separating ores and coal." The ores and coal are to be first dried and sifted, and then they are exposed to the action of a strong blast of air, whereby they are cleansed from dust and dirt, and driven to lesser or greater distances, so as to fall, according to their specific gravity, into different divisions. The process is specially applicable to the precious metals.

[Printed, 9½*d.*]

A.D. 1853, March 16.—N° 654.

COLT, Samuel.—" Improved apparatus for heating and annealing metals." An annealing furnace is described consisting of a cast-iron box, supported on the walls of the furnace, and placed above the fire bars. The box is covered with a lid, " and passing " from end to end thereof, and reaching through to the front wall " of the furnace, is a tube, whose ends are open," so as to provide " a sight hole in the box to enable the attendant to watch the " progress of the heating operation." The furnace is in other respects similar to one of ordinary construction.

Secondly, a smith's forge is described, having a cast-iron hearth, with its centre sunk so as to form a fireplace, which is closed at the bottom by a box constituting the ashpit. Immediately above the fireplace is a fire brick, which throws down the flame upon the sides of the hearth. Anthracite coal may be used. A supply of coal being placed on the sides of the hearth, it is gradually heated by the flame deflected by the fire brick, and is then raked on to the fire as required. The blast is introduced into the closed box. The fuel in the fireplace is kept about level with the hearth, and the rods or bars to be heated are introduced through openings into the forge, and are laid upon the fuel instead of being thrust into it, as is ordinarily done.

Two or more smiths may work at the same forge, according to the number of openings made for the introduction of the metal.

[Printed, 8½*d.*]

A.D. 1853, March 18.—N° 678.

MACKAY, George,—" Improvements in the manufacture of " iron." (*A communication.*) The invention consists in a method of decarbonizing the iron ore after it has been through the process of deoxidation, and thereby reducing it at once from the ore to a malleable state. This is proposed to be done by the action of blasts of air, hot or cold, impinging upon the melting or melted metal.

A furnace is described, consisting of several hearths placed successively behind the fireplace. Beyond these, at the back of the furnace, is a table, on which the charge is allowed to fall from a feeding hopper. Flues from the hearths pass underneath this table, and heat the charge preparatory to its being introduced into the nearest hearth. Above each hearth is a pipe or tuyere for introducing the blast, which may be cold, or heated by passing the air beneath the bottom of the hearth, which is thereby kept from rapidly burning out. The introduction of the blast is not to be " mistaken for " those intended "to effect a more perfect combina- " tion." " The intention of the present device is quite different, " viz., to decarbonize the ore," and so produce malleable iron direct from the ore. The fuel and pulverised ore being raked into the first hearth, they are there acted upon by the blast, and the process of burning out the carbon from the metal commences, and is carried on as rapidly as possible by directing the downward blast, hot or cold, upon it, the blast being regulated by a valve. The blast " absorbs the carbon and refines the ore." The metal is then passed on to the second hearth, and the heat is increased, and the operation of the blast upon the metal is repeated. It is then passed on to the balling hearth, and the operation of the blast being still continued, the loop is there formed and refined. Meanwhile the other hearths are successively preparing fresh masses of metal to be operated upon as before described.

[Printed, 5½*d.*]

A.D. 1853, March 19.—N° 683.

DALTON, George.—" Certain improvements in melting or re- " ducing iron ore, iron stone or slag, or scoria." A provisional *Specification* was deposited, the application for the Patent was *not duly* proceeded with. It stated the invention to consist in a process of pulverising iron ore, stone, or slag, and mixing it with charcoal, coke, lime, or clay. Being thoroughly mixed before being introduced into the furnace, the aid of a blast was to be dispensed with.

[Printed, 2½*d.*]

A.D. 1853, March 22.—N° 700.

JOHNSON, John Henry.—"Improvements in the modes of "smelting iron and other ores." (*A communication.*) The application for Letters Patent was not proceeded with, a provisional Specification was deposited, which stated the invention to consist in smelting the ore mixed with charcoal by the application of the electric light. The ore is to be placed between the poles of two large electrodes connected with a galvanic battery and be thus melted; as it and the slag fall they are caught in a receiver, their different specific gravities keeping them separate.

[Printed, 2½*d.*]

A.D. 1853, March 22.—N° 701.

JOHNSON, William.—"Improvements in rolling and shaping "metals." (*A communication.*) The Specification and Drawings describe a system of rollers, some working horizontally, others vertically, or at different angles, for rolling annular or other shaped objects, such as solid railway wheels, wheel tyres, bars, cylinder and valve covers, boiler ends, flat plates, discs and cones. The shapes of the rolls vary according to the form required to be given; for instance, if a solid railway wheel is to be rolled in a horizontal position, two radiating rolls, rolling horizontally, and of the required form, give shape to the upper surface, and an under die of corresponding shape revolves beneath, supported on a table revolving on conical rollers; it is thereby pressed against the wheel between the under and upper rollers, and gives it the required shape. Vertical rollers may be made to operate at the same time on the periphery, and so form the tyre. Other articles are to be similarly formed by means of a revolving die below in combination with rolls of various contours radiating from a centre and rolling above them.

[*Printed, 5½d.*]

A.D. 1853, April 4.—N° 804.

MAY, Charles.—" Improvements in machinery for manufac" turing and rolling iron." The machinery is specially applicable for rolling railway bars; the heavy fly wheel is dispensed with and smaller fly wheels are substituted. Four steam cylinders in two pairs are used, each pair acting on one shaft with their cranks at right angles and a driving pinion on the shaft, which is common to two cylinders. The pairs of cylinders are placed on opposite sides of a large central wheel, and if the teeth of the opposite pinions be properly engaged, a power as nearly as possible uniform is produced, and dead points are avoided. Sieman's chronometric governor is employed to regulate the speed of the engine.

2ndly. A train of rolls is so arranged that each pair revolves in an opposite direction to the preceding pair, and so the labour of lifting the bar over the rolls is avoided. The rolls are to be of larger diameter than usual, and they and their axes are to be cast hollow. Two or more pairs of rolls may be so arranged that the bar shall go straight forward through the series. They must be set just so far apart that the rail on clearing one pair is ready to enter the next pair.

[Printed, 5½*d.*]

A.D. 1853, April 5.—N° 816.

HALEY, Joseph.—" Improvements in machinery for forging " iron," &c. The application was not proceeded with, a provisional Specification was deposited. It describes a steam hammer consisting of an oscillating cylinder, whose piston is attached to the helve of a forge hammer. The back or tail end of the hammer rests in a piece which may be raised or depressed so as to adjust the hammer to work of varying sizes.

[Printed, 2½*d.*]

A.D. 1853, April 6.—N° 825.

LEACHMAN, Henry.—" Improvements in the manufacture of " iron." A composition, consisting of 120 lbs. of brickdust or calcined clay, 600 lbs. of common salt, and 280 lbs. of black *oxide of manganese*, all powdered fine, and mixed together, is *proposed to be used* in the " boiling process" of making iron. For poor qualities of iron 10 lbs. of the mixture should be used with a charge of 420 lbs. of metal. For better sorts less may be used, down to 4 lbs. The powder should be thrown in all at once, and well stirred with the metal, and is said to produce a superior malleable iron.

[Printed, 2½*d.*]

A.D. 1853, April 12.—N° 880.

VERDIE, François Felix.—" Improvements in welding cast " steel with iron," &c. The article on which cast steel is to be welded is heated, covered with borax, and placed in a mould, leaving a space round it of the size of which the coating of steel is required to be. Fluid cast steel is run into the mould, and so becomes attached to the article. Tyres of railway wheels may be thus made. The articles, when so coated, should be finished by hammering or rolling.

[Printed, 2½*d.*]

A.D. 1853, April 14.—N° 912.

ZENNER, David.—" Improvements in the treatment of ores and " other substances containing metals to obtain products there- " from, and the apparatus used therein." These refer to modes of treating pyritical ores containing iron, and separating from them the sulphur and arsenic they contain; also to the production of salts of iron. Suitable apparatus, consisting of retorts and condensing vessels, is described.

[Printed, 6½*d.*]

A.D. 1853, April 18.—N° 929.

STEVENS, William Walker.—" The application of retorts in " gas ovens or other ovens, and gas ovens or other ovens which " are constructed as retorts, to the process of improving iron, and " converting iron into steel." The iron is to be put in and taken out of the retorts while they are at a high heat, and thus the time usually required for heating and cooling them is to be saved. Gas retorts are to be used when unemployed in making gas, effecting economy in time, labour, and material.

[Printed, 2½d.]

" large tube is also provided at the small end with a flange or " shoulder at the inner side, and at the same end of the inner or " smaller tube is turned or screwed a short cylindrical part, so as " to fit the aperture of the inner shoulder of the outer tube," thereby connecting the two tubes of the tew iron at the nozzle end, and securing them together by screwing or driving the inner one into the outer one, or in any other convenient manner.

[Printed, 5½*d.*]

A.D. 1853, May 18.—N° 1223.

WALKER, BERNARD PEARD, and WARREN, JAMES.—" Improvements in the manufacture of iron." The iron is melted in an ordinary blast furnace, and conveyed in a fluid state to the improved puddling furnace of the patentees. This consists of a fire grate of an ordinary construction, with which is connected a moveable or revolving hearth or "containing vessel," made of iron lined with brick, or of other suitable material. This hearth is made to rotate by any convenient means, and is inclined at an angle to its axis of rotation. It is surrounded with a cast-iron casing. The melted metal being introduced into the revolving hearth, it is there agitated, and so puddled without the aid of hand labour. The hearth is heated by the flames from the fire, or waste products of combustion from the blast furnace, which are admitted between the revolving hearth and the casing, and are carried off by the chimney. The iron may, if necessary, be melted in the puddling furnace.

[Printed, 7½*d.*]

A.D. 1853, May 23.—N° 1272.

JOHNSON, JOHN HENRY.—"An improved forge hammer." (*A communication.*) The Specification and Drawings, which should be referred to, describe a vertical hammer, which is elevated by cams in the ordinary way. The upper end of the hammer as it rises comes in contact with the end of a piston, which works in a cylinder supplied with compressed air or steam, which may be used as a cushion during the ascent of the hammer, and during its descent acts upon it, and accelerates its motion. The apparatus is arranged so as to regulate by valves the admission and exit of the steam or compressed air.

[Printed, 1*s.* 1½*d.*]

A.D. 1853, May 26.—N° 1293.

COWPER, Charles.—" Improvements in the manufacture of " iron." (*A communication.*) " Carbonaceous shale or schist " is to be used for mixing with iron ores and lime in the blast furnace. The proportions of schist to be employed will be determined by analysis and experience. A larger produce of iron is said to result from the employment of schist.

[Printed, 2½*d.*]

A.D. 1853, May 26.—N° 1296.

SAUNDERS, Jonathan.—" Improvements in the manufacture " of railway and other wheel tyres." The application for this Patent was not proceeded with, and a Provisional Specification only was deposited.

Nine parts of muriatic acid and one of sulphuric are mixed together. To one part of this mixture are added 20 parts of muriate of soda, more or less, according to the quality of the iron acted upon, and this compound is added by degrees to the charge of iron about) 4 cwt.) in the puddling furnace, and is said to produce superior steel and iron suitable for wheel tyres.

[Printed, 2½*d.*]

A.D. 1853, June 2.—N° 1353.

HATTERSLEY, Richard Longsden.—" Improvements in " machinery for forging iron and other metals." The Specification describes apparatus consisting of swages, dies, and hammers, specially applicable to forging flyers for spinning machinery and other similar articles of iron and steel.

[Printed, 7½*d.*]

A.D. 1853, June 7.—N° 1400.

DAVIS, Thomas, and BLOOMER, Boaz.—" Improvements in " the manufacture and piling of iron to be used in the production " of railway chairs." The application for this Patent was not proceeded with.

A complete Specification was filed with the petition, and describes the invention as consisting in rolling lengths of iron in bars or strips, and combining them when disposed in certain forms or layers inclined at an angle to one another, as shown in the Drawing annexed to the Specification, the object being to give strength to the iron.

[Printed, 4½*d.*]

A.D. 1853, June 13.—N° 1430.

SPENCER, JOSEPH.—" A new or improved cupelo." This cupelo is made double. To the ordinary cupelo (or cupola) " a " second cupelo or reservoir" is added, "for containing an " additional quantity of iron," the second cupelo being connected with the first, so that the iron fused in it may be drawn off from the tap hole of the first, or, when required, from its own tap hole.

[Printed, 2½*d.*]

A.D. 1853, June 14.—N° 1442.

TALABOT, JOSEPH LEON, and STIRLING, JOHN DAVIE MORRIES.—" Improvements in the manufacture of iron." These consist in running iron from the blast furnace into sand beds, chills, or cast-iron moulds, in which are placed oxides of metals, by preference, magnetic oxides or powdered hœmatites, and wood, sawdust, or other ligneous or oily matters. Where zinc, tin, or other metals are required to be added to the iron to impart to it certain properties, as has been done in the puddling and other processes, oxides of those metals are, with wood, sawdust, or other similar matters, placed in the sand beds or moulds or chills. Thus zinc imparts "strength and brightness;" tin imparts hardness and a crystalline structure; oxides or carbonates of the oxides of calcium tend to prevent "cold-shortness." The quantities of oxides and ligneous matter to be used may be about five per cent. of the estimated charge of iron. Resinous wood sawdust is preferred, and where the oily or other matters given off produce much ebullition, less of these matters will be required proportionally. The iron produced is greatly improved for the manufacture of malleable iron. When the oxides of tin, zinc, or other metals are used to impart their peculiar properties to the iron, the oxides, or their combinations which are reducible at the temperature of the iron, are applied in the moulds, by preference with, or, if desirable, without oxide of iron, in the proportion of about half per cent. or more by weight.

[Printed, 3½*d.*

A.D. 1853, June 14.—N° 1443.

NEWTON, Alfred Vincent.—" An improved mode of manu-" facturing cast steel." (*A communication.*) The object of the improvements is to economise the fuel used in making steel. Instead of introducing blistered steel into the ordinary melting furnace in crucibles in a cold state, it is previously heated to a high temperature in another preparatory or auxiliary furnace, which may be a reverberatory or other suitable furnace. The crucibles are heated in an annealing oven, then removed to the auxiliary furnace, and subjected, while empty, to great heat for about half an hour; they are then charged with the blistered steel, and kept at a high welding heat for about two hours, then removed while hot to the melting furnace, which is maintained at the usual high heat. In about an hour and a half the steel will be melted, and ready to be poured into moulds in the ordinary way.

[Printed, 3½*d.*]

A.D. 1853, June 23.—N° 1529.

BURROWES, James.—" Improvements in the formation of " metallic plates," &c. The application for this Patent was not proceeded with.

The Provisional Specification describes the improvements as consisting in forming metallic plates suitable for being rivetted for boilers, tanks, &c. with lap joints, the sides or ends of the plates where they are to be rivetted being rolled in a taper form with a swell, or otherwise made thicker than the other parts.

[Printed, 2½*d.*]

A.D. 1853, June 23.—N° 1530.

DODDS, Thomas Weatherburn.—" Improvements in the " manufacture of files, rasps, and other edge tools usually made " of steel." Edge or cutting or abrading tools are made from the ordinary raw metal, such as wrought iron or partially converted steel, and are subsequently hardened or " converted " by placing them in a chamber containing a mixture of carbonaceous matter, charcoal by preference, and potash, pearlash, soda, soda ash, or other alkaline matter, limestone, and carbonates and bicarbonates of lime, as marble chippings, gypsum, oyster shells, and any material forming animal charcoal.

In carrying out the invention, furnaces similar to those described in the patentee's Specification of his former Patent, (See Number 571, p. 134.) are to be employed, and the further processes of manufacture are similar to those therein described, except that more animal charcoal should be employed in this manufacture.

The essential object of this invention is the case-hardening of files and other tools, which are made of a high quality and at a cheap rate, being formed from raw or partially converted iron, and afterwards hardened. In making circular or annular files, the file is made of ordinary raw metal, and afterwards converted by the method described. The annular file is then fitted on a grooved disc or supported on arms attached to a shaft or mandril in any convenient way. A set of files may be made to fit on the same disc, and be replaced as required. These annular files may be advantageously used for making forks by filing out the intervening metal between the prongs.

[Printed, 5½*d.*]

A.D. 1853, July 8.—N° 1625.

CORNIDES, Louis.—" Improvements in treating certain ores " and minerals for the purpose of obtaining products therefrom." The invention relates to a process of separating an amalgam of quicksilver and the precious metals from sand and earthy matters.

[Printed, 7½*d.*]

A.D. 1853, July 9.—N° 1637.

RIEPE, Ewald.—" Improvements in moulds for steel castings." (*A communication.*) The moulds are made with their bodies of the ordinary loam or other material, " but all those parts which come " into direct contact with the steel are formed of a fireproof " mixture which becomes spongeous or porous when dry," and yet is cohesive and plastic. The mixture preferred is composed of one part of rich fire clay and five parts of powdered crucibles, such as are used for melting steel.

[Printed, 2½*d.*]

A.D. 1853, July 11.—N° 1650.

DALTON, George.—" Improvements in reverberatory and other " furnaces." These relate to an improved mode of introducing atmospheric air to the fireplaces. The air is made to enter through openings in the front or sides of the furnace, or above the fire bars, and passes through suitable flues or channels in the sides, bottom, or other heated surfaces of the furnace, so as to collect as much waste heat as possible, and afterwards enters into a closed ashpit through openings in the cast-iron plates surrounding the ashpit, which is entirely closed in front. The heated air is thus introduced under atmospheric pressure only.

[Printed, 5½*d.*]

A.D. 1853, July 13.—N° 1665.

TABBERNER, John Loude.—"Improvements in the manu- "facture of iron." The application for this Patent was not proceeded with.

The Provisional Specification states that the invention consists in reducing ironstone to powder, and then smelting it with fluxes in a blast furnace

[Printed, 2½*d.*]

A.D. 1853, July 14.—N° 1672.

HENDERSON, William.—"Improvements in the construction "of furnaces for the purpose of obtaining products from ores." Calcining furnaces are described having double arches and corresponding flues and dampers, heated by equal numbers of fires at each end of the furnace. The furnaces are specially applicable for the manufacture of sulphuric acid.

[Printed, 6½*d.*]

A.D. 1853, July 14.—N° 1673.

BROOMAN, Richard Archibald.—"Improvements in the "manufacture of anvils." (*A communication.*) The anvils are made with a steel face and steel horn or beak and a cast-iron body, or the horn may be of malleable iron welded to the steel face. The body is cast on to the steel face by preparing a suitable mould, and an aperture or cavity is left in the body which is necessary to enable the face to be properly tempered after being cast. This is done by reheating the anvil and applying water in the usual way to the surfaces of the face and the cavity, thus *ensuring an* equal shrinkage in the metal.

[Printed, 5½d.]

A.D. 1853, July 15.—N° 1680.

NASMYTH, JAMES.—" Improvements in machinery and apparatus employed in rolling plates and bars of iron and other " metals." The application for this Patent was not proceeded with. The Provisional Specification describes a means of reversing the action of rolls at any time, and avoiding the necessity of passing the work over them. This is to be done by reversing the motion of the steam engine through the agency of their valves alone.

[Printed, 2½*d*.]

A.D. 1853, July 20.—N° 1717.

SMITH, EDWIN DALTON.—" Improvements in crushing and " washing ores and earths."—The Specification describes apparatus consisting of toothed rollers or discs revolving loosely upon radial arms attached to a vertical shaft, which crush the ores upon a plate. And also similar toothed discs attached to a frame inside a revolving drum. The machinery is specially applicable to crushing auriferous ores and earths.

[Printed, 5½*d*.]

A.D. 1853, July 25.—N° 1745.

IRELAND, WILLIAM.—" Improvements in the mode or method " of melting or fusing iron or other metals, and in the apparatus " employed therein."

These refer, 1st, to an improved method of feeding the furnace or cupola, " which prevents the flame from appearing at or above " the charging door " during the charging, or " until the time of " blowing down." This is done by charging the furnace with fuel " to about 2 feet above the twyer," then arranging the pig metal or portions thereof " one above the other, crosswise," all the ends facing the twyer, and the interstices being filled up with scraps of metal and coke.

2ndly. The furnace is made much higher than usual, with the boshes low down, and having a taper form above the contraction to prevent the metal from sticking.

3rdly. Hot air is introduced by means of a common fan or *blower with suitable* pipes and communications.

[Printed, 7½d.]

A.D. 1853, August 3.—N° 1815.

RODEN, William Sargeant, and THOMAS, William.—"Improvements in rolling metals." The object of the improvements is to save the time and trouble lost in lifting the work over the rolls. This is effected by "employing two or more pairs of rolls "unconnected with each other, and revolving in contrary directions," being driven by the same or by a separate moving power. When the bar or plate has been passed through one pair of rolls it is moved to the other pair by the means ordinarily used, or by a moveable carriage or frame or truck running on rails, or otherwise moved as required.

[Printed, 6½*d.*]

A.D. 1853, August 4.—N° 1824.

RODEN, Richard Brown.—"Improvements in rolling iron "and all other malleable metals and alloys." These are "improvements in rolling mills where what are called 'three high rolls' "are used," and consist in "causing the middle roller to remain "stationary as to position, and of moving or adjusting the upper "and lower rollers to or from the middle roller to which the "power for driving the rolls is applied." By these means heavy pieces of metal may be readily rolled with three rolls, as has been previously done for small sized iron. In order to lift heavy work, as blooms, "a moveable platform is used before the rolls connected to the piston rod or other suitable part of an engine," by which great weights are readily raised.

[Printed, 5½*d.*]

A.D. 1853, August 6.—N° 1843.

MORRISON, Robert.—"Improvements in apparatus for forging, shaping, and crushing iron, &c. The improvements consist in substituting for the ordinary hammer block, piston, and piston rod a cylindrical bar of wrought iron or other metal to form the acting hammer. "On this bar or piece of metal the working "piston together with the guiding surfaces for the working movements are forged or cast solid, as the case may be," the bar itself is "truly turned throughout." The steam cylinder is "bolted to a pair of plate standards stiffened at the back by strong "ribs." The piston bar works through "upper and lower stuffing boxes in the cylinder," while it is guided by a T-head at its upper projecting end.

[Printed, 8½*d.*]

A.D. 1853, August 11.—N° 1869.

HALL, Kelley Thomas.—"Certain improvements in forge "hammers." The forge hammer is constructed so as to allow of a transverse or lateral motion to suit various kinds of work. The framing supports three shafts, a driving shaft, and intermediate carrier shaft, and a square shaft to which the hammer is attached. The "three shafts are coupled together by means of antifriction "rollers." The driving end of the intermediate shaft is mounted on one end of a lever, and its friction roller is capable of being thrown out of contact with the other two. Upon the other arm of the lever is an inclined plane adjustable by means of a screw, and acted upon by a cam mounted on the hammer shaft, so that the screw regulates the height to which the hammer is raised.

[Printed, 5½*d.*]

A.D. 1853, August 12.—N° 1880.

STRONG, James.—"Improvements in furnaces for smelting "ironstones and ores." The furnace described in the Specification is in the form of an inverted cone, tapering from the tunnel head, where it is very wide, down to the hearth, being about 40 feet high and 18 feet in diameter at the top. The area of the furnace at the top is to be very large, by preference the square of its diameter should be 8 times the height of the furnace. The furnace is surrounded with an iron air chamber whence the blast is introduced into the furnace through "twyers" placed at various heights.

[Printed, 6½*d.*]

A.D. 1853, August 12.—N° 1887.

BROOMAN, Richard Archibald.—"A method of producing "castings in malleable iron." (*A communication.*) Wrought iron is so prepared that it may be cast into moulds for the production of malleable castings, such as railway wheels, &c. The metal employed may be either scrap, wrought iron, or bars, or plates cut into pieces. It is melted in crucibles, such as are used for melting blister steel. With a charge of iron suited to the size of crucible are mixed half per cent. by weight of charcoal or other carbonaceous matter, and one per cent. of manganese, and one per cent. of salammoniac. These are placed in the crucible and melted, and then poured into moulds. Railway wheels may be cast with a chill, and "will, moreover, be malleable," and may be forged under the hammer.

[Printed, 2½*d.*]

A.D. 1853, August 15.—N° 1907.

TALABOT, Joseph Leon, and STIRLING, John Davie Morries.—"Improvements in the manufacture of cast steel." The character of steel is modified "by combining with blister "steel when melting it oxides of metals, or of the earthy bases," and thus producing cast steel of the character required. See N° 1442, p. 144. By mixing with highly carburetted blister steel from one to three or four per cent. of oxide of iron (by preference magnetic ore), cast steel of hardness diminished in proportion to the oxides used, will be the result. Oxides of calcium and lime have a similar effect in reducing hardness, and may be used in the proportion of from $\frac{1}{200}$ to $\frac{1}{50}$ part of the weight of the steel. Oxide of tin used with soft or mild blister steel gives it hardness. Proportions of from $\frac{2}{1000}$ to $\frac{1}{1000}$ produce a marked effect. From $\frac{1}{400}$ to $\frac{1}{200}$ by weight of oxide of zinc will produce a toughening effect. Oxides of barium and other earthy bases, and oxides of manganese, may be also used to reduce hardness. The oxides should be introduced into the crucibles with the blister steel, or when the metal is in a pasty state.

[Printed, 2½*d.*]

A.D. 1853, August 27.—N° 1994.

NEWTON, Alfred Vincent.—"An improved construction of "steam hammer." (*A communication.*) In place of the induction and eduction valves, slides, and rods hitherto used for actuating a steam hammer, "a single valve and valve rod, with the necessary "induction and eduction ports," may be employed. The hammer, as it rises and falls, opens the induction and eduction ports. A lever and stop, screwed on the valve rod, are employed to regulate the force of the blow.

[Printed, 5½*d.*]

A.D. 1853, August 27.—N° 1995.

ROBINSON, George.—" A novel application of the slags or " refuse obtained during the manufacture of metals." The slag obtained from manufacturing iron and other metals is run in a molten state upon a heated-iron table, and formed into plates or sheets, by rolling or other suitable means. These are then annealed, and may be applied for roofing and other useful purposes.

[Printed, 3½*d.*]

A.D. 1853, September 3.—N° 2040.

STICKNEY, George.—" Improved machinery for forging " metals." A vertical hammer is used, which moves in guides. It is raised by means of a rotating central screw shaft, into the thread of which a tooth attached to the hammer takes. When the hammer is raised to a certain height it is brought into contact with a stationary lock, which holds it suspended independently of the screw shaft, by the outer end of its tooth. It is then released by hand or mechanical means, and allowed to fall. Several hammers in several pairs of guides may be actuated by the central screw shaft.

[Printed, 6½*d.*]

A.D. 1853, September 8.—N° 2069.

BURROWS, James.—" Improvements in the formation or con- " struction of rolled metallic plates." The application for this Patent was not proceeded with.

The Provisional Specification describes iron or other metal plates suitable for boilers and other purposes, which are to be rolled with raised ribs on their surfaces to strengthen them. To save weight of metal the plates may be recessed on the reverse side, in parts corresponding to the raised ribs.

[Printed, 2½*d.*]

A.D. 1853, September 12.—N° 2113.

NEWTON, Alfred Vincent.—" Improved machinery for " crushing and grinding mineral and other substances." (*A communication.*) The machinery consists of a rotating vessel or shell, in which are placed balls, which, by their centrifugal action, crush the minerals introduced within them. The balls are moved by a disc attached to the shaft of the drum, which is recessed to admit them, or by arms, or are carried on axles journalled to the arms, or in any other suitable manner.

[Printed, 5½*d.*]

A.D. 1853, September 13.—N° 2116.

DUBS, HENRY.—" Improvements in the method of forging or " manufacturing iron and steel." These apply specially to the forging of crank axles, railway wheels, and larger forgings. Hydraulic pressure is used to forge them by means of gradual compression. A hydraulic press is employed, having an upper bed or framing to receive a top die, and a lower bed to receive a bottom die. The metal prepared for being forged is placed between the dies, and compressed into the required form.

[Printed, 5½*d.*]

A.D. 1853, October 3.—N° 2255.

THOMPSON, WILLIAM JOSEPH.—" Improvements in heating " reverberatory and other furnaces." (*A communication.*) The bars of the furnace are flat plates, and are ranged parallel to each other, the back ones being successively placed lower than the front ones, like steps, and the edge of one bar being under the one before it, so that small coal can be consumed, and the fuel as it burns gradually falls to the back of the fire. At the upper part of the grate is a feeding hopper, and at the lower part is a box or chamber, into which the well ignited fuel falls. A blast is forced into this box from several twyers. Also streams of heated air are conducted under the fire bridge, and introduced above it.

[Printed, 5½*d.*]

A.D. 1853, October 15.—N° 2578.

JOHNSON, JOHN HENRY.—" Improvements in the manufac- " ture of iron." (*A communication.*) These relate to a mode of manufacturing wrought iron directly from the ore by means of a continuous operation. The ores are roasted and pulverised, and are then placed upon a series of "deoxydising" tables, made of iron, soap-stone, or other material, and heated by waste gases *from furnaces*, or by heating furnaces directly applied beneath

A.D. 1853, November 4.—N° 2568.

JOHNSON, John Henry.—" Improvements in the manufacture of malleable iron, which improvements are also applicable " to the manufacture of other malleable metals." (*A communication.*) The application for this Patent was not proceeded with. The invention as described in the Provisional Specification relates to the manufacture of wrought iron for railway axles, rails, tyres, &c., and consists in twisting a number of bars singly, and fagotting, rolling, and welding them, in the ordinary way, so as to produce a tough metal. Tyres may be made of twisted bars, welded so as to be without any breaking joints. Plates also may be made by laying twisted wires interlaced side by side and welding them.

[Printed, 2½*d.*]

A.D. 1853, November 11.—N° 2615.

PLATT, John.—" Improvements in apparatus or machines for " forging," &c. The application for this Patent was not proceeded with.

The Provisional Specification refers to apparatus for forging spindles, &c. by means of hammers and bottom swages.

[Printed, 2½*d.*]

A.D. 1853, November 12.—N° 2622.

BARKER, Stephen.—" Improvements in shaping metals," &c. These relate to a mode of forming ornamental metallic wire for the edges of plated wares by rolling apparatus, having the rolls so grooved as to give the requisite shape and ornamental form to the wire edges.

[Printed, 4½*d.*]

A.D. 1853, November 17.—N° 2662.

CLARE, John.—" Improvements in the manufacture of bar and " sheet metals, and in machinery connected therewith, and in the " application of such metal to various useful purposes." The Specification and Drawings describe bars of iron formed in various angular, T, and other shapes. Also, plates of iron formed with grooves, tongues, and flanges, suitable for ship building and other purposes. Also, a screw press, and machinery for rolling metallic staves for being made into casks.

[Printed, 1*s.* 0½*d.*]

A.D. 1853, November 18.—N° 2687.

NORRIS, Richard Stuart, and TALBOTT, Ebenezer.—"An improvement or improvements in the manufacture of iron." The invention refers to the use of two refineries placed between and connected with two puddling furnaces, so that each may be alternately worked, and be ready to receive the charge from the blast furnace without any loss of time, and with more certainty and uniformity than by the old method.

[Printed, 5½*d.*]

A.D. 1853, November 28.—N° 2757.

STENSON, Joseph.—"Improvements in the manufacture of "iron." The object of the invention is to avoid "lamination" in wrought iron. This is proposed to be effected by making the rough forge bars in a fluted or corrugated or zigzag form, and forming the pile of short lengths of such bars, fitting the corrugated parts together. Upon the top and underneath each pile is placed a bar corrugated on one side only, being flat on the face, which is placed outermost. The pile so formed is hammered in the usual way.

[Printed, 7½*d.*]

A.D. 1853, December 9.—N° 2873.

BOURNE, John.—"Improvements in machinery for the pro-"duction of iron ships," &c. The Specification and Drawings describe a moveable punching and rivetting machine, whereby the iron plates are punched and fixed in their places at one operation.

[Printed, 1*s.* 1½*d.*]

A.D. 1853, December 10.—N° 2881.

JOHNSON, John Henry.—"Improvements in furnaces for "the manufacture of steel." (*A communication.*)

An arrangement of furnace is described, consisting of two melting chambers, one on each side of the ashpit, communicating with one chimney. The gases may be employed on their way to the chimney to heat a boiler. A metal plate is employed to catch the steel if any escape from the crucibles.

In a second arrangement double heating or melting chambers are used, heated by one furnace, on each side of which the crucibles are placed, and having one chimney. Beneath the grate is a pi for supplying hot or cold air. In these furnaces inferior fuel may be burned. The roof is arched with a central projection, so as to deflect down the heat upon all the crucibles. The chambers may be divided into compartments, so as to facilitate the examination of the crucibles separately.

Thirdly, a furnace is described with one large and two smaller crucibles. A large door is made to admit them, and the furnace is supplied with air by a number of pipes opening into the ashpit.

[Printed, 11½*d.*]

A.D. 1853, December 10.—N° 2883.

GUIBERT, Nicolas Victor.—" Improvements in forge hammers." The hammers are vertical, and are worked by means of two pullies placed in contact. A toothed collar and endless screw are employed to direct the fall of the hammers.

[Printed, 7½*d.*]

A.D. 1853, December 15.—N° 2908.

HOWELL, Joseph Bennett, and SHORTRIDGE, John. —" An improvement or improvements in the helves of tilt ham-" mers." The application for this Patent was not proceeded with. The Provisional Specification describes buffalo hide as being suitable for constructing the helves of both hammers. Strips of the hide are placed one above the other, and combined into a mass with thongs or hoops of metal, so as to form a helve.

[Printed, 2½*d.*]

A.D. 1853, December 17.—N° 2938.

HORTON, Joshua.—" Improvements in the manufacture of " certain kinds of metallic vessels." Cylindrical vessels, such as iron bottles for holding mercury, are made by bending a plate into the form of skelps by means of a mandril. The skelps are rolled so as to form a tube, which is cut into the required lengths, The tops and bottoms are fastened by welding in the ordinary way, or by rolling.

[Printed, 7½*d.*]

A.D. 1853, December 17.—N° 2941.

STIRLING, John Davie Morries.—" Improvements in the " manufacture of iron." The application for this Patent was not proceeded with.

The Provisional Specification describes the improvements as consisting in applying to the beds of puddling and refinery furnaces oxides of iron and other metals, and ligneous, resinous, tarry, or oily matters, and running molten iron thereon.

[Printed, 2½*d.*]

A.D. 1853, December 19.—N° 2952.

WAYGOOD, Richard.—"Improvements in portable forges." The application for this Patent was not proceeded with.

The Provisional Specification states the improvements to consist in so constructing the forges that they may be easily taken to pieces. The upper part is made of a shallow rectangular form, divided by partitions, which may be removed. The bellows are made of such a form as to fit inside the forge, and the tue iron is divided into two parts. All the parts may be packed inside the forge.

[Printed, 2½*d.*]

A.D. 1853, December 20.—N° 2962.

BURROWS, James.—"Improvements in the formation of such "metallic plates as are required to be conjoined by rivetting or "other similar fastening." Plates of iron and other metals required to be rivetted are made with lap joints, having their edges thicker than the other parts, or tapering in thickness, by being bevelled from one end or side to the other. Plates thus shaped with lap joints afford a greater strength in the parts joined together than plates of uniform thickness.

[Printed, 6½*d.*]

A.D. 1853, December 31.—N° 3036.

WAYGOOD, Richard.—"Improvements in portable forges." In consequence of the patentee having neglected to file a complete Specification, this Patent became void.

The Provisional Specification describes a forge capable of being disconnected and packed in a small compass. The bellows are made with india-rubber cloth instead of leather.

[Printed, 2½*d.*]

1854.

A.D. 1854, January 5.—N° 25.

RIGBY, WILLIAM.—" Improvements in steam hammers and " pile-driving machinery." The steam hammers are vertical and direct acting. When steam is used in the ascent of the hammer only, the hammer block is made in the form of a plunger or ram passing through stuffing boxes at both ends of the cylinder. The upper part of the plunger passing through the upper gland is larger in sectional area than the lower part passing through the bottom gland; and on steam being admitted below the shoulder of the large part the plunger is raised, and allowed to fall by its own weight. When the steam is made to act both upwards and downwards the ram works only through the bottom of the cylinder, the top forming a piston on whose upper and under surfaces the steam acts during the descent and ascent respectively. In these arrangements the cylinder and stuffing boxes act as guides.

[Printed, 10*d.*]

A.D. 1854, January 6.—N° 35.

STIRLING, JOHN DAVIE MORRIES.—" Improvements in the " manufacture of iron." The Specification refers to the Specification of a prior invention of the patentee and Joseph Leon Talbot, dated June 14, 1853, (see N° 1442, p. 144.) in which the use of metallic oxides was referred to, and describes further improvements upon that invention, being the employment of chlorides, phosphates, and carbonates, with or without oxides of iron or other oxides, in the manner described in the former Specification referred to. To give the iron a hardened character, chloride of tin, used by preference in combination with oxide of iron, is added at the rate of about 1 per cent. by weight of the iron run into the moulds or pig bed. In like manner, carbonate of zinc is added at the rate of ½ to ¾ per cent. by weight of the pig iron. In like manner, chlorides, phosphates, carbonates of the alkalies, and the alkaline earths are added, to cleanse and purify iron, at the rate of about 1 or 1½ per cent. by weight of the iron. Also petroleum, peat, resin, or other bituminous or tarry matter may be used with, or instead of, ligneous or oily matters in combination with the metallic oxides, as before described. Equal bulks of wood, sawdust, and hœmatite were recommended to be used in the prior Specification referred to, but when more gas is evolved less hœmatite is requisite. With pure bituminous substances about ¼ or ⅕ of the bulk of hœmatite is sufficient.

[Printed, 3*d.*]

A.D. 1854, January 12.—N° 86.

MACLAREN, ROBERT.—" Improvements in moulding or shaping " metals." The mould boxes are made of the usual form, but the lower box has a moveable bottom which may be raised within the box to a limited extent. The upper box has a similar moveable bottom placed in a reversed position. The boxes are filled with sand from a hopper or in any other convenient way, and the pattern is placed in its usual position. Pressure is then applied by means of a screw or hydrostatic pressure, and the top and bottom are pressed together with considerable force, pressing the sand equally on the pattern, and forming the required mould.

[Printed, 10*d.*]

A.D. 1854, January 17.—N° 110.

MACLAREN, ROBERT.—" Improvements in moulding or shaping " metals." The application for this Patent was not proceeded with.

The Provisional Specification describes a modification of the patentee's prior invention (see above N° 86). It consists in effecting moulding action by a single operation of mechanical pressure.

[Printed, 3*d.*]

A.D. 1854, January 18.—N° 122.

HOWARD, CHARLES.—" Improvements in the manufacture of " iron." In order to improve the quality of iron the ores are to be washed and crushed, and their quality ascertained by analysis. They are then combined with the proper proportions of suitable fluxes, alkalis, and alkaline solutions, and are mixed with powdered fuel in a suitable machine, and are finally submitted to the action of heat in the intimately combined state described.

[Printed, 3*d.*]

A.D. 1854, January 19.—N° 126.

BURSILL, George Henry.—" Improvements in operating on " metalliferous ores and slags. These relate specially to processes for crushing and working gold, silver, and copper ores, and slag obtained in the operations of working those ores.

[Printed, 5*d.*]

A.D. 1854, January 19.—N° 132.

BROWNENTT, Henry.—" Treating scrap and waste iron so as " to render the same more readily available in the manufacture of " iron." The application for this Patent was not proceeded with. The invention related to a process of pressing together scrap or waste iron by placing it in a box or frame, and subjecting it to great pressure by a hydraulic press or other means, rendering it thereby more available for the manufacture of iron.

[Printed, 3*d.*]

A.D. 1854, January 20.—N° 140.

CHASE, Oliver Rice.—" Pulverising machinery." The Specification describes a combination of a series of rotating cells and stampers acting within a suitably shaped vessel for pulverising ores and other substances.

[Printed, 1*s.* 7*d.*]

A.D. 1854, January 24.—N° 178.

RIDGWAY, John.—" Improvements in the method of generating and applying heat to kilns, ovens, and furnaces for " manufacturing purposes." The Specification and Drawings which are necessary to understand the invention fully, describe a furnace applicable to the manufacture of pottery, and also of iron. The heat may be raised to and maintained at any required degree of temperature by means of a system of dampers and flues with valves and regulators, which, together with a central tube fixed in the middle of the furnace, allow an upward and downward current to be produced alternately or simultaneously.

[Printed, 1*s.*]

A.D. 1854, January 26.—N° 196.

REEVES, Charles, **junior, and WELLS, William.**—" *Improvements in casting* metals." The object of the invention is to obtain a sounder and more uniform casting. This is effected by making the mould moveable, and delivering the stream of metal at a fixed point, and also making the mould descend so as to keep the metal in the mould nearly at the same level as the metal in the crucible; or the result is obtained by raising the vessel from which the metal is delivered.

[Printed, 8*d.*]

A.D. 1854, January 27.—N° 201.

CRANE, Patrick Moir.—"An improvement in the manu-"facture of iron." This relates to a method of turning to a useful account the waste gases generated in the blast furnace; which is effected by blowing a blast of hot or cold air from blowpipes placed above the twyers down upon the gases as they rise from the twyer. The Specification and Drawings describe the mode of constructing or altering furnaces as required for employing this process.

[Printed, 10*d.*]

A.D. 1854, January 31.—N° 236.

HAZLEHURST, Isaac.—"Improvements in the manufacture "of iron by blast, and in the construction of furnaces and "machinery for the same." The furnace bottom is made circular or nearly so, and a circular hole is left in its top for the introduction of peculiar tools to be used in the puddling and balling process. Above this hole is a vertical revolving shaft to which the tools may be attached at pleasure, and be made to revolve by the machinery and stir up the iron. The tools are, first, a vertical stem with two jointed legs which open and form with the stem a T-shape. This, being attached to the revolving vertical shaft, causes the boiling operation to take place; it is then removed and cooled in a cistern, and a rake-like tool is put in its place, which revolves, and, with the aid of the puddler's "paddle," balls the iron. A blast is introduced under the ashpit by a T-shaped pipe with perforations in its upper surface.

[Printed, 6*d.*]

A.D. 1854, January 31.—N° 240.

***WRIGHT,* William, and BROWN, George.**—"Improve-"*ments in* cupolas, which improvements are also applicable to "smelting and other furnaces." The cupolas and furnaces are arranged with heating chambers in their lower parts for heating the blast. This, when heated, is introduced in a higher part of the furnace, and directed downwards upon the fuel and charge.

[Printed, 9*d.*]

A.D. 1854, January 31.—N° 243.

BROOMAN, RICHARD ARCHIBALD.—"Improvements in the "manufacture of steel." (*A communication.*) Steel manufactured in reverberatory furnaces at a cherry heat is said to be defective because the siliceous matters are not properly separated. It is proposed to substitute a yellow and white heat to cure this defect. A mixture of $\frac{2}{3}$ salt and $\frac{1}{3}$ manganese is to be added to the fused refined metal, while being puddled, in proportions of about $3\frac{1}{2}$ parts of mixture to 380 or 400 parts of fused metal. The mixture softens and purifies the iron. The carbon is to be consumed until the metal "commences to become fagotable." The workman must then desist from stirring with the puddling tool, and merely stir with a straight rod, so as to mix the metal well. When the grains become cohesive, steel is produced. In treating forge pig iron, when the fusion is complete, cold scoria is thrown in the furnace, the chimney is closed, and the metal is stirred until it granulates. $1\frac{1}{2}$ parts of the above mixture are then added to about 380 or 400 parts of the metal. The chimney is gradually opened, and the heat raised to the highest possible point. $1\frac{3}{4}$ parts of the mixture are then thrown in, and the stirring operations are proceeded with as described for the refined metal.

[Printed, 4*d.*]

A.D. 1854, February 1.—N° 246.

CHENOT, C. B. ADRIEN.—"Improvements in accumulating, "conducting, and treating gases of combustion, and also in generating and applying the same to metallurgic and other purposes." The Specification describes the application of certain principles to modes of collecting and purifying gases by gas metres and pipes, and of enriching them by separating hydrogen from the carbonic acid; also a system of generating and classifying gases, and applying them to melting, refining, and welding metals.

[Printed, 1*s.*]

A.D. 1854, February 3.—N° 269.

COLLETTE, Charles Hastings.—" An improved method of " reducing ores." (*A communication*). The ore is placed in a retort which is hermetically closed, and then heated to redness. Gases such as hydrogen, carbonic oxide, carburetted hydrogen, are introduced into the retort by pipes or other suitable means, and so pass through the contents thereof, which are thus reduced.

[Printed, 3*d.*]

A.D. 1854, February 4.—N° 279.

BOYDELL, James.—" An improvement in the beds of reverberatory furnaces used for puddling iron." The refuse product of pyrites is picked, so as to exclude such pieces as contain much sulphur or other impurities; and the more pure peroxide of iron is selected and used in the same manner as ordinary materials for making the furnace beds.

[Printed, 3*d.*]

A.D. 1854, February 16.—N° 375.

STIRLING, John Davie Morries.—" Improvements in the " manufacture of steel." These relate to making steel from cast iron by melting it with successive quantities of oxides of iron in quantities of about from 7 to 5 per cent. of the oxides at the first, and less at each succeeding melting. Carbonates of the oxides may be used, and magnetic and hœmatite ores are preferred. The steel thus produced has peculiar properties imparted to it by melting therewith certain metals or oxides; such as zinc, tin, bismuth, antimony, or arsenic. Zinc and its oxides give strength, closeness of grain, and brightness, and may be used at the rate of $\frac{1}{400}$th to $\frac{1}{200}$th by weight. Tin and its oxides give increased hardness and closer grain, and may be used at the rate of $\frac{1}{2000}$th to $\frac{1}{1000}$th by weight. Calcium gives softness and toughness, and may be used at the rate of $\frac{1}{200}$th to $\frac{1}{100}$th by weight.

[Printed, 3*d.*]

A.D. 1854, February 21.—N° 408.

RAMSBOTTOM, John.—" Improvements in welding." The Specification and Drawings describe apparatus for welding surfaces *of iron by forcing* them into close contact, and rubbing them together while at a welding heat. This is done in the case of wheel tyres by means of "gabs" which hold the two ends of the bent hoop close together, and with a short up and down motion rub and so weld them together. The surfaces of other articles are welded in a similar way by rubbing them together while at a welding heat.

[Printed, 10*d.*]

A.D. 1854, March 9.—N° 568.

SWAN, JOHN HOLLEY.—" Improvements in the tuyeres of blast " and other furnaces and fires." The tuyeres are constructed with a pipe for supplying them with water, and a passage to allow of its passing freely away, so as to keep up a free circulation of the liquid supplied.

[Printed, 6*d.*]

A.D. 1854, March 11.—N° 596.

SPARROW, JAMES.—" Improvements in shears for cutting " iron and other metals." The application for this Patent was not proceeded with.

The improvements described in the Provisional Specification refer to the use of a sliding wedge to actuate the upper or lower cutter of the shears.

[Printed, 3*d.*]

A.D. 1854, March 13.—N° 605.

WALKER, JOHN.—" Improvements in stamping or crushing " machinery." The application for this Patent was not proceeded with.

The Provisional Specification describes stampers actuated by levers set in motion by means of the rollers of a tappet wheel.

[Printed, 3*d.*]

A.D. 1854, March 18.—N° 647.

THORNE, WILLIAM.—" Improvements in reducing metallic " ores." Provisional protection was obtained, but the application for this Patent was not proceeded with.

The invention relates to crushing and grinding apparatus specially adapted for working ores containing precious metals.

[Printed, 3*d.*]

A.D. 1854, March 20.—N° 650.

HODGE, Paul Rapsey.—" Improvements in reducing metallic " ores." The application for Letters Patents was not proceeded with.

The Provisional Specification describes machinery for crushing and grinding ores, especially auriferous ores, by means of rolling balls.

[Printed, 3*d.*]

A.D. 1854, March 20.—No. 658.

CHENOT, C. A. Bernard.—" Improvements in the manufacture of steel, iron, and different alloys, cast, welded, and " moulded." These are described under ten heads. The ores are separated and sorted by means of an electric sorting machine, and are reduced into "metallic sponge by any reducing agent, " but particularly by pure carbonic oxyd, as derived from the " carbonic acid resulting from the reduction." The mode of treating and working up the " metallic sponges by pulverising, " compressing, and moulding operations " is fully described.

[Printed, 6*d.*]

A.D. 1854, March 23.—N° 687.

LISTER, Alfred.—" Improvements in the manufacture of " metallic castings." The application for Letters Patent was not proceeded with.

The Provisional Specification states that the improvements relate to the use of plaster of Paris for making the patterns from which the moulds are made in sand.

[Printed, 3*d.*]

A.D. 1854, March 25.—N° 701.

GIBSON, Thomas, and KNIGHTON, William.—" Improvements in moulding and casting metals." The application for Letters Patent was not proceeded with.

The invention relates to an arrangement of ovens and a turn-table for introducing the moulds to be dried. One portion of the table enters the drying oven while the other receives the moulds, and then is introduced in turn.

[Printed, 3*d.*]

A.D. 1854, April 1.—N° 751.

JOHNSON, William.—"Improvements in the treatment or "reduction of metallic ores or salts." (*A communication.*) The application for Letters Patent was not proceeded with.

The invention relates to the use of metallic vapours of cadmium, zinc, and mercury in reducing ores of manganese, aluminium, sodium, potassium, &c.

[Printed, 3*d.*]

A.D. 1854, April 1.—N° 754.

BROCKLEBANK, George. — "Improvements in obtaining "metals from ores." A Provisional Specification was deposited, but the application for Letters Patent was not proceeded with. It relates to stamping and washing machinery suitable for working the precious metals.

[Printed, 3*d.*]

A.D. 1854, April 4.—N° 766.

HIGGIN, James.—"Improvements in the mode or method of "separating metals from each other when in conjunction, and in "obtaining useful products therefrom." These relate to the use of acids, either alone, or mixed with an oxydising substance, or chlorine, for separating the tin from scrap-tin plate, and to the production of ammonia in the process of separation.

[Printed, 4*d.*]

A.D. 1854, April 7.—N° 811.

JOPLING, Jonathan. — "Improvements in preserving the "tuyere used for blowing in forge and other furnaces from the "action of the fire." The nozzle for the end of the tuyere is made of two pieces forming an annular chamber or chambers through which the air is made to pass from the tuyere into the furnace.

[Printed, 7*d.*]

A.D. 1854, April 7.—N° 821.

NAYLOR, William. — "Improvements in power hammers." The hammers are worked by a vacuum and steam, or by a vacuum alone. The hammer block is connected with the lifting piston by solid or tubular piston rods, and a spring is used to accelerate the motion of the hammer, and act as a buffer if it be raised too high.

[Printed, 1*s.* 4*d.*]

A.D. 1854, April 8.—N° 830.

WILLIAMS, William, and WILLIAMS, Thomas Evan.—"Improvements in reverberatory furnaces." These relate to a mode of constructing several furnaces heated by one fire. The fireplace has three bridges, and a reverberatory furnace is constructed for each bridge. The flues are arranged so as to exclude cold air from entering the body of any of the furnaces, and heated air is introduced to facilitate combustion.

[Printed, 6*d.*]

A.D. 1854, April 15.—N° 878.

BELLFORD, Auguste Edouard L.—" Certain improvements " in the manufacture of steel and wrought iron directly from the " ore." (*A communication.*) The ore is pulverised, and well mixed with charcoal or other carbonaceous matter, and with or without fluxes. It is then placed in a tubular or other suitably shaped vessel, and heated. It is next transferred directly, with as little loss of heat as possible, to close crucibles, and melted; it is then drawn off, and cast in moulds. If finer qualities of steel be required, the metal is conveyed in a fused state, with as little loss of heat as possible, by a passage not exposed to the air, to a decarbonising chamber heated from without. There it receives " the action of decarbonising and pure gases " or steam, and is manipulated to produce "good spring or wrought steel direct." Spring steel may be made by conveying the metal in its granular or pulverised state directly to the close refining chamber without its being melted, or it may be manipulated in a reverberatory furnace. An arrangement of furnaces is described in which reducing, smelting, and refining furnaces are combined. In the refining furnace jets of air, heated or cold, are injected in any convenient manner; or steam or decarbonising gases are injected " to assist the process of decarbonisation, and also to increase the " temperature of the furnace, and generally to purify the metal."

[Printed, 10d.]

A.D. 1854, April 20.—N° 907.

HUNT, Edmund.—" Improvements in treating minerals for the " extraction of their valuable metals." The application for letters patent did not proceed to the great seal.

The Provisional Specification states that the minerals are to be first subjected to heat in a furnace, then plunged into water to be made friable, and afterwards crushed and worked up in the ordinary way.

[Printed, 3*d*.]

A.D. 1854, April 22.—N° 925.

MOUCHEL, Pierre Jean Felix.—" Improvements in melting " and in treating the ores and metals." The ores are calcined in a suitable furnace and pulverised, and are then mixed with proper fluxes, and introduced into a furnace which has an inclined plane or surface of firestone or other suitable material on which they are placed. Through a suitable aperture or tuyere a blast of air is introduced, and at the same time powdered charcoal or other carbonaceous matter. The operation of the three agents, air, powdered carbonaceous matter, and pulverised calcined ore, effects an " immediate reduction and fusion of the metal."

[Printed, 7*d*.]

A.D. 1854, April 25.—N° 943.

STURGES, Richard Ford.—" Improvements in joining metals." These relate to the use of cadmium as a solder for joining metals or metallic alloys suitable for being electro-plated or electro-gilt.

[Printed, 3*d*.]

A.D. 1854, April 28.—N° 963.

TIZARD, William Littell.—" Certain apparatus for roasting " and calcining ores and minerals, and separating metals there- " from," &c. The application for this Patent was not proceeded with.

The apparatus described in the Provisional Specification consists of an iron cylinder open at both ends, lined with fire-brick, having a furnace at its base. Inside this is a vertical cylindrical shaft, with a spiral perforated floor, on which the ores are placed, as they are fed from a hopper by means of rolls which crush them as they are delivered. The shaft with its spiral floor is made to rotate, and the ores as they descend the spiral floor are agitated and calcined by the heat rising from the furnace placed at or near its base. The heated ore then passes through a perforated spout, and is cooled by jets of water falling from a tank above. It then falls into a pulverising, or, if requisite, an amalgamating, machine, and is divested of arsenical and other compounds, which may be driven off by the heat applied.

[Printed, 3*d.*]

A.D. 1854, May 1.—N° 970.

PORTER, JOSEPH, and HOWSON, RICHARD.—"Improvements "in forge hammers." The hammer head is adjusted in vertical guides; it is raised by a toothed wheel or segment or rack, and allowed to fall partly by its own weight, partly by means of atmospheric pressure acting on a piston rod "springing from the top "of the hammer head." Self-acting adjustable motions are attached to regulate the fall and force of the blow.

[Printed, 1*s.* 1*d.*]

A.D. 1854, May 4.—N° 1001.

NASMYTH, JAMES.—"An improvement in the process of pud"dling iron." The object of the invention is the "disengagement "of the carbon from the molten metal."—This is done by subjecting the "molten cast iron in the puddling or refining furnace "to the action of a current or currents of steam introduced as "nearly as practicable to the lowest portion of the molten iron, "and thence diffused upwards, so as not only mechanically to "agitate the molten iron, and thereby keep exposing fresh sur"faces of the iron to the oxygen contained in the atmosphere "passing through the furnace, but also when brought into contact "with the incandescent iron to be reduced to its elements and yield "oxygen." The oxygen combines with the carbon, and also the sulphur and other oxydizable substances in the iron, and removes them. The liberated hydrogen combines with any sulphur present in the furnace, which is thus carried off. A suitable furnace for effecting these purposes is described and shown in the Drawings. Water may be introduced in small quantities into the molten metal to produce similar effects, but is not recommended. The steam, when a ployed, must be equally diffused. For a charge of 392 lbs. of Scotch, 203 pig iron, and 88 lbs. of white Staffordshire pig iron; the introduction of steam shortly after the iron is melted, for from two to five minutes, is attended with very beneficial results.

[Printed, 10*d.*]

A.D. 1854, May 6.—N° 1018.

DREWE, Henry Gregory. — "Improvements in obtaining "metals from ores." These relate to machinery for crushing ores to powder by crushers sliding in an annular groove, and to amalgamating the powder by a process used in treating ores of precious metals.

[Printed, 9*d.*]

A.D. 1854, May 10.—N° 1042.

REECE, Rees.—"The smelting of iron by means of turf or peat "simultaneously with the combustion of the peat, and collection "of the products therefrom." The Specification refers to that of a former Patent, dated January 23, 1849, which related to the mode of treating peat and obtaining products therefrom. It proceeds to describe furnaces in which the peat is used for smelting iron, and at the same time the products of combustion, tar, water, gases, &c., are collected by flues, condensers, &c., and are applied to useful purposes. The tar is converted into paraffine and oil, the water furnishes acetate and carbonate of ammonia and methylic alcohol, and the gases are used for heating purposes.

[Printed, 1*s.*]

A.D. 1854, May 18.—N° 1112.

JOHNSON, William.—"Improvements in the treatment and "manufacture of metals and metallic ores." (*A communication*). The application for this Patent was not proceeded with.

The provisional Specification states that the invention relates to the manufacture of iron and steel. A blast is obtained from "a "rotatory helical cone blower," which may work in combination with a fluid receiver to blow damp or moistened air. A variety of chemical agents, chlorides, fluorides, ferrates, &c., are enumerated as being employed in the process to be pursued.

[Printed, 3d.]

A.D. 1854, May 27.—N° 1180.

HIPKISS, Joseph.—" Improvements in puddling furnaces used " in the manufacture of iron." The cinder obtained from the furnace is used for the beds of puddling furnaces, either alone or mixed with pottery or other iron ore. When fused, it is drawn off into a suitable cast-iron or other receptacle. This substance is used for making or repairing the beds of puddling furnaces.

[Printed, 3*d.*]

A.D. 1854, June 8.—N° 1262.

WILSON, John.—" An improved pump," applicable to mines, wells, &c., and " raising melted metals in foundries," &c. The Specification and Drawings describe two pump barrels connected with an air vessel from which rises a main pipe. The apparatus is said to be suitable for raising mercury or molten metals.

[Printed, 6*d.*]

A.D. 1854, June 10.—N° 1286.

ALEXANDER, Edwin Powley.—" Improvements in mould- " ing." (*A communication.*) The application for Letters Patents was not proceeded with.

The Provisional Specification describes a method of making moulds for casting toothed wheels by machinery, without using patterns. A rotating arm with a scraper forms the circular portions, suitable scrapers form the spokes, and the teeth are formed by inserting small pieces of clay, made hollow for the rim, by apparatus similar to a dividing engine.

[Printed, 3*d.*]

A.D. 1854, June 15.—N° 1299.

WILSON, Thomas, and HADLEY, John.—" A new or im- " proved mode of constructing certain kinds of rolls or cylinders and " dies or surfaces." The invention relates to the construction of steel rolls for ornamenting metallic surfaces. The figures or patterns are formed separately, and attached to the rolls by screwing or other means of fastening.

[Printed, 6*d.*]

A.D. 1854, June 15.—N° 1303.

STIRLING, John Davie Morries.—" Improvements in the " *manufacture* of iron." (*Partly a communication.*) " Heretofore

" it has been usual in some cases to run melted iron into the " refinery and puddling furnaces. Part of this invention " consists in causing the beds of such furnaces to be covered with " or have applied thereon oxides of iron or some other metal, " or of some of the earthy bases, with sawdust or other ligneous or resinous or tarry or oily and such like matters, and " running the molten iron thereon." Such matters may also be introduced into the furnace, and mixed with the molten iron. About five per cent. of the oxides of iron may be used with the melted iron, combined with oxides of tin or other metal in small quantities. The invention further consists in using a mixture of the oxides of iron or their compounds and cinder in a state of fusion, and adding thereto a quantity of cast iron in a fluid state, the result being malleable iron. As soon as ebullition is finished, or nearly so, a piece of wrought iron is introduced, to which the newly-formed wrought iron will attach itself, and which is to be pressed gradually by any suitable instrument. About 80 lbs. of cinder, with $\frac{1}{5}$ by weight of oxide of iron, preferring hœmatite free from clayey matter, may be melted in a furnace, and about 1 cwt. of melted cast or refined iron is added. A piece of wrought iron, of a thin spiral form, is introduced, and forms a nucleus to which the particles of malleable iron will adhere as they form. The mass in about twenty minutes may be withdrawn, and worked up under the hammer. In subsequent charges about 7 or 10 per cent. by weight of oxide will be sufficient. The melted iron, when run in, should always be covered by melted cinder and oxide. The character of the iron may be varied according to the oxides employed.

[Printed, 4*d.*]

A.D. 1854, December 11.—N° 1309.

HARGROVE, Charles.—" An improvement or improvements " in the manufacture of certain kinds of iron." These relate to such kinds of iron as after being cast are capable of being made malleable or annealed by being heated in contact with hœmatite ore. After the cast iron has been smelted, wrought-iron scraps or cuttings are introduced into the furnace. Three times the weight of wrought iron may be mixed with the melted cast iron, whose property it acquires, the mixture is fusible and capable of being annealed.

[Printed, 3*d.*]

A.D. 1854, June 20.—N° 1345.

STEPHEN, Alexander, and PIRNIE, Alexander.—“Improvements in templates and materials used in the construction of iron ships or boilers,” &c. The invention relates to templates made of open-woven or close-perforated substances, as wire or other cloth, sheet metal, &c. These are applied to the rivet holes to which the plate is to be fitted. Their positions are marked thereon, and are so transferred to the plate to be punched.

[Printed, 10*d.*]

A.D. 1854, June 22.—No. 1370.

BROWN, William Henry.—“An improvement in the construction of furnaces for the melting of steel and other metals requiring a crucible in the melting thereof.” The application for Letters Patent was not proceeded with.

A portable furnace is used, made of cast or wrought iron, lined with firestone or firebrick or other suitable material. It is suspended on axes on a moveable carriage, and the crucible is placed in it, so that it may with the carriage “be drawn out entire from under the flues or stack.” The metal is poured out “by tilting the entire furnace (crucible included) by a pulley or block.” An auxiliary furnace is used for heating the steel before putting it in the crucible.

[Printed, 3*d.*]

A.D. 1854, June 22.—N° 1372.

BELLFORD, Auguste E. L.—“Improvements in machinery for forging or hammering iron,” &c. (*A communication.*) Two or three hammers are used, two striking horizontally on the two sides of the object to be forged, by themselves, or in conjunction with another striking it on the top. The anvil has a movement which causes it to descend just before the blow from the side hammers is struck, and to ascend before the blow of the upper hammer is given.

[Printed, 10*d.*]

A. D.1845, July 4.—N° 1461.

MAC GAFFIN, John.—“Improvements in corrugated cast *iron.*” These refer to forming cast angle iron with corrugations, either on all the parts, or in such a manner that some parts may be plain and others corrugated; this applies to T L and H cast and angle iron.

[Printed, 3*d.*]

A.D. 1854, July 8.—N° 1502.

ROBINSON, WILLIAM, and CRIGHTON, ROBERT.—" Im-" provements in machinery or apparatus for rolling metals into " suitable shapes or forms." Machinery is described suitable for rolling nuts of screw bolts and other similar articles. The peripheries of the rollers are fluted or formed according to the figure in which the article is required to be made.

[Printed, 1*s.* 1*d.*]

A.D. 1854, July 14.—N° 1549.

MAC GAFFIN, JOHN.—" Improvements in the mode of corrugating angular iron." These refer to the rolling of wrought iron angle T or H, or any such forms, with any or all the flanges corrugated. The requisite sized corrugations are formed by dies or a second set of rollers placed at the requisite angles, having corrugations in them, and fitting into each other.

[Printed, 3*d.*]

A.D. 1854, July 15.—N° 1563.

WAGSTAFFE, MATTHEW FRENCH, and PERKINS, JOHN WILLIAM.—" Improvements in obtaining metals from ores and oxides." The ore is pulverized and treated with sulphuric, nitric, or hydrochloric acids, or mixtures thereof. Sulphurets of metals are broken and roasted at a red heat. Soda or potash is added in a state of carbonate for the precipitation of the metals from the metallic solutions as carbonates; the remaining solution of neutral salts may be used for commercial purposes, such as nitrates of soda or potash, &c. Carbonates of metals may be converted into commercial articles by the ordinary mode of purification; or the metals may be deposited from the solutions by the ordinary processes of electro-metallurgy.

[Printed, 3*d.*]

A.D. 1854, August 7.—N° 1730.

LUCAS, SAMUEL.—" An improved mode of manufacturing *steel.*" *Bar iron* is " converted into bar steel in the presence of

" iron ore, which ore " is at the same time "itself converted into steel." The bar iron is piled in layers in a converting furnace having intermediate layers of broken iron ore, or scale, scrap, or filings, or other oxide of iron, mixed with manganese and charcoal. The ore should be broken about the size of walnuts, and mixed with about equal quantities of animal or vegetable charcoal, and with manganese at the rate of about half a pound to 1 cwt. of iron ore, less or more manganese being used according to the degeee of hardness required in the steel.

The converting furnace is charged with layers in the following order:—First, a layer of charcoal; secondly, a layer of the mixture; thirdly, a layer of charcoal; fourthly, a layer of bar iron; and the layers are then repeated until the furnace is full. The bar iron must not be allowed to touch the ore, as the latter would adhere to it in lumps. The converting process is then carried on in the usual way, and the iron, both in bar and in the ore will, after the furnace is heated and allowed to cool, be found to be converted into steel. The ore may be also converted alone without the presence of bar iron.

[Printed, 3*d.*]

A.D. 1854, August 18.—N° 1806.

HILL, John Reed.—" Improvements in machinery for pulveris-" ing metallic ores," &c. The application for Letters Patent was not proceeded with.

The Provisional Specification describes conical rollers revolving on a horizontal bed plate which has a circular depression gradually deepened in the centre to fit the rollers. A sliding as well as a rolling motion is thereby obtained, which adds greatly to the crushing power.

[Printed, 5*d.*]

A.D. 1854, August 18.—N° 1815.

CALVERT, Frederick Crace.—" Improvements in the treat-" ment of heating, puddling, and refining iron slags or cinders." The object sought to be attained is, the production of better cast and wrought iron by the use of slags and cinders properly prepared. This is proposed to be done by effecting a complete fluxing of the slags or cinders, and so preventing the silica, sulphur, or phosphorus they contain from coming in contact with the cast iron.

The slag or cinder, either before or after being calcined or roasted, is ground into coarse powder, and mixed with half its weight of slacked lime, and made into a thick paste, which is formed into lumps or bricks with or without coal dust or charcoal, and is introduced, dried or calcined, or not, into the furnace, and melted in the usual way.

[Printed, 4*d.*]

A.D. 1854, August 21.—N° 1835.

SMITH, William Henry, BESSEMER, Henry, and LONGSDON, Robert.—"Improvements in the manufacture "and treatment of slag and vitreous substances, and the com"bination of other substances therewith." The slag produced by smelting iron or other metals is run from the furnace, by means of a gutter or pipe of fire clay or other suitable substance heated by a flue or otherwise, into pots or receptacles kept at a great heat ready to receive the fluid slag. Metallic oxides, alone or mixed with alkaline salts, are used to give colour to the slag, and powdered burnt clay, or slaked lime, or sand, or other mineral substances, are added to give it the peculiar properties which they impart. These substances are all heated before being mixed with the molten slag. The slag is cast in the shape of various articles as required, as table tops, chimney-pieces, statues, &c., which are then taken on a carriage or otherwise to an annealing oven and annealed in the usual way.

[Printed, 3*s.* 2*d.*]

A.D. 1854, September 18.—N° 2016.

SMAL, Oscar Delloye.—"A new system of ovens for metals." The application for Letters Patent was not proceeded with.

Above the fireplace of the oven are to be placed two chambers connected with the fireplace by side flues, which conduct the heat and flames to the chambers. The vertical side flues are connected together by horizontal flues open to the atmosphere, and provided with dampers for regulating the heat of the chambers.

[Printed, 3*d.*]

A.D. 1854, September 19.—N° 2019.

DAWES, William Henry.—"An improvement in the manu"*facture of iron.*" This relates to combining the processes of squeezing and hammering blooms. The bloom after having been first squeezed by any ordinary sqeezer, is next hammered by a forge or other hammer. The successive processes improve the quality of the iron by making it "sounder, tougher, and more "fibrous" than iron treated by either process singly.

[Printed, 3*d.*]

A.D. 1854, October 2.—Nº 2109.

SHERIFF, Thomas.—"Improvements in moulding or shaping "metals." Circular moulds for pipes and cylinders and other similar articles are formed gradually from the bottom upwards by means of two or more rollers, by preference of a conical shape, which are made to run round in a revolving frame, and thus press or roll down the sand which is placed between the centre pattern piece and the inside of the mould box. The pattern piece and the rollers are made to rise as the mould is formed. Instead of rollers a screw blade or blades may be used for affecting a similar purpose.

[Printed, 7*d.*]

A.D. 1854, October 11.—Nº 2174.

BOULLET, Jean, F.J.A.—"Improvements in the manufacture "of steel." Articles of wrought iron, sheets, bars, or parts of machinery are converted into steel by placing them in a suitable furnace, such as is described in the Specification, and employing a cementing substance consisting of glucose or saccharine matter, horn dust or shavings, animal fat or blood, and wood charcoal dried and pulverised. The iron and the cementing mixture are placed in alternate layers and heated in the usual way.

[Printed, 5*d.*]

A.D. 1854, October 21.—Nº 2247.

EDWARDS, William Alexander.—"Separating iron or "steel from brass, gun metal, and all other metallic filings." The application for Letters Patent was not proceeded with.

A revolving bar or cylinder of iron is placed in the centre of a coil of wire, and being magnetised attracts the iron or steel particles, and separates them from other metals with which they may be mixed.

[Printed, 3d.]

A.D. 1854, October 25.—Nº 2270.

HENDERSON, WILLIAM.—" Improvements in treating certain " ores and alloys, and in obtaining products therefrom." These relate to processes for working the precious metals, and zinc and other volatile metals.

[Printed, 4*d.*]

A.D. 1854, October 26.—Nº 2282.

HEALEY, JOHN, FOSTER, JOHN, and LOWE, JOHN.—" Improvements in machinery to be used for drawing, moulding, " forming, and forging articles in metal." Rolls having suitable indentations and grooves on the peripheries are used in connection with striking hammers for making spindles, flyers, and similar articles.

[Printed, 11*d.*]

A.D. 1854, October 26.—Nº 2287.

GRIFFITHS, JAMES.—" Improvements in the manufacture of certain kinds of iron," &c. " Iron of small sizes " may be manufactured by forming "strands " of twice the width of the size proposed, and dividing them lengthwise by a cutting apparatus described. The "billets " are prepared by similarly dividing puddle or piled bars longitudinally. Rolls are used which may be adjusted by " a scroll formed on the pin or spindle, and working against a " corresponding fixed scroll abutting against a part of the bolster " or housing." The spindle is turned by a worm or endless screw acting on a worm wheel fixed on its upper part.

[Printed, 7*d.*]

A.D. 1854, October 27.—Nº 2289.

BELLFORD, AUGUSTE, E.L.—"Improvements in trip hammers." (*A communication.*)" The rod of the hammer is provided with a piston working in a cylinder having valves for regulating the admission and emission of air. The action of the hammer is thereby placed under control, and its force may be regulated at pleasure.

[Printed, 6*d.*]

A.D. 1854, October 27.—Nº 2291.

***PRICE, ASTLEY* PASTON.**—" Improvements in the calcination " *and oxidation* of certain metallic, mineral, and metallurgical "compounds," &c. The metals are calcined and oxidised in tubes or retorts placed horizontally or inclined, and made to revolve. A stream of air or steam, or both, is admitted into the retorts and passed through the metals while heated.

[Printed, 1*s.*]

A.D. 1854, October 28.—N° 2294.

ADCOCK, Henry.—"Improvements in strengthening castings "of iron and other metals." The application for this Patent was not proceeded with.

Rods or strips of wrought iron are introduced into the moulds, and the cast metal is made to incorporate them with the castings, thereby giving them strength.

[Printed, 3*d.*]

A.D. 1854, November 2.—N° 2327.

HARGROVE, Charles.—"Improvements in annealing cast "iron or in rendering cast iron malleable." A series of ovens or annealing chambers are substituted for the iron pans usually employed for containing the articles to be annealed, which are embedded in iron or peroxide of iron. The ore or peroxide suffers a partial reduction in the annealing process. It is, however, recovered and prepared again for use by moistening it with water, or diluted hydrochloric or nitric acid, or chlorine or its compounds, and exposing it to the air.

[Printed, 6*d.*]

A.D. 1854, November 7.—N° 2358.

BIRD, John.—"Improvements in reverberatory furnaces." The object of the invention is to save fuel. Two sets of fire bars are used in combination with a closed ashpit. In one set the bars are placed in a horizontal position, or only slightly inclined; in the other the bars are considerably inclined, so that the fuel placed thereon slides down upon the horizontal bars, thereby affording an extensive surface for the passage of air from the closed ashpit. The air may be highly heated by making the arch or top of the furnace hollow, and admitting the air to that hollow part, or by introducing the air into the closed ashpit through passages made in the sides or bottom of the furnace.

[Printed, 8*d.*]

A.D. 1854, November 13.—N° 2404.

CADDICK, David.—“ Improvements in puddling furnaces.” The application for Letters Patent, made on November 13, 1854, was not proceeded with.

The Provisional Specification describes furnaces proposed to be constructed with “ a wrought-iron plate on each back and front “ side, extending from top to the bottom and from end to end “ of the furnace, with suitable openings.” The “ tool boshes” have flues leading into upright flues formed in the angles of the shaft or chimney, by which the steam generated by the hot tools being put in the water in the tool boshes may pass away outside the shaft or chimney, and so cool it. A flue is also made at the back side of the furnace leading to the flues outside the shaft, through which a rush of air passes, and mixing with the steam tends to cool the chimney. The flue from the furnace to the shaft has a moveable iron bottom which may be removed to enable the flue to be cleaned. When the charge is withdrawn, blasts of cold air are to be projected against the hot bed from suitable apparatus applied to the outside of the furnace.

[Printed, 3*d.*]

A.D. 1854, November 14.—N° 2408.

KIRKUP, Lancelot.—“ Improvements in anvils.” The anvils are forged in one piece without any welding, and may be case-hardened. The upper solid surface is made large in area and small in depth, and is supported on a hollow truncated pyramid of cast metal or other suitable material.

[Printed, 6*d.*]

A.D. 1854, November 23.—N° 2476.

SHAW, Stephen.—“An improved mode of marking metal “ plates for rivetting.” The Specification describes an apparatus called “ a reverser ” for marking iron or other metal plates to be rivetted. Perforated sheets of gutta percha or other suitable material are used for the templates.

[Printed, 10*d.*]

A.D. 1854, December 4.—N° 2548.

FOTHERGILL, Benjamin.—“ Improvements in machinery or “ apparatus for working metals.” The application for Letters was not proceeded with.

The invention consists in the application of rollers with or without portions of their surfaces cut away, and of moulds and dies for forming wrought iron in the required shapes suitable for parts of machinery and other implements.

[Printed, 3*d.*]

A.D. 1854, December 13.—N° 2632.

EVANS, LLEWELLYN WILLIAM, and McBRYDE, JAMES.—"Improvements in kilns for burning sulphuret ores," &c. The kilns are made of ordinary construction, but have a blast pipe or pipes attached whereby a blast of air may be introduced into the kiln, and be driven through the burning materials. A sliding grate is placed at the bottom of the kiln to facilitate the removal of the oxides after the burning operation is completed.

[Printed, 6*d.*]

A.D. 1854, December 15.—N° 2641.

SCOTT, URIAH.—"An improved method of constructing hollow "and solid metallic bodies." The application for Letters Patent was not proceeded with.

Sheets of metals are rolled either cold or hot into the required shapes. The sheets are laid on a slab or table and rolled round a mandril, with spelter or other suitable cementation placed between them. They are then passed between rollers.

[Printed, 3*d.*]

A.D. 1854, December 18.—N° 2661.

GILPIN, WILLIAM, and BOWEN, ABRAHAM.—"Furnaces and "ovens," &c. The application for Letters Patent was not proceeded with.

Angular bars are placed in the door of the furnace, and may be applied as grate bars to prevent the radiation of heat. An extra door or slide is added to regulate the supply of air. A machine in the form of a screw is applied to exhaust or draw from furnaces or sewers all smoke, gases, and volatile residuum.

[Printed, 3*d.*]

A.D. 1854, December 19.—N° 2670.

FAVREL, AUGUSTE FRANÇOIS JOSEPH.—"A new machine for "beating precious metals, applicable to leather and to forging."

The Specification describes a vertical steam hammer with suitable apparatus for adjusting the position of the work as it is required to be operated upon in the beating or forging operations.

[Printed, 1*s*.]

A.D. 1854, December 27.—N° 2729.

DUNN, JOHN LANG.—"Improvements in working up waste "sulphates and nitrates, and manufacturing useful products "therefrom." These relate to modes of treating and usefully applying the waste products obtained in etching printing rollers and other surfaces as nitrates of iron or copper or sulphate of lead.

[Printed, 3*d*.]

A.D. 1854, December 27.—N° 2731.

COMSTOCK, JOHN.—"Certain improvements in trip hammers." These relate to the application of "a loose belt with cams and "other parts, so that a forging hammer can be brought to strike "light or heavy blows, or the hammer entirely stopped, although "the power which drives the parts continues its motion.

[Printed, 9*d*.]

A.D. 1854, December 29.—N° 2744.

NASMYTH, JAMES.—"Certain improved machinery or apparatus "for facilitating the forging of masses of iron." The Specification describes hydraulic cylinders and other apparatus, with beams, rails, chains, pullies, &c. worked by steam or other power, for raising and moving masses of iron and conveying them from the heating furnace to the forge hammer, and moving them as required to be operated upon during the forging process.

[Printed, 1*s*. 6*d*.]

A.D. 1855.

A.D. 1855, January 8.—N° 45.

Mc CALL, Robert.—" Certain improvements in the manufac-" ture of iron and steel." A closed furnace is used instead of open furnaces for smelting with peat fuel iron ores and pig iron, and also for manufacturing bar iron. The closed furnace is furnished with valves for regulating the heat, and the gases of combustion are used for drying fuel and other purposes. Air furnaces are described which may be used for creating draught, and be closed by dampers. The fuel to be used in the closed furnace is peat or vegetable carbon, either in its natural state or prepared by being dried and compressed, and used alone or mixed in equal proportions with small anthracite coal.

[Printed, *7d.*]

A.D. 1855, January 9.—N° 58.

BOW, Ebenezer.—" Improvements in the manufacture or " production of blackening for foundry purposes." The "blackening" is prepared from what is known in Scotland as " boghead or " Torbane Hill mineral," and coals and minerals of that class, by burning or distilling it, and draining off the volatile constituents, leaving a black residuum. This is ground and prepared in the ordinary way for " blackening."

[Printed, *3d.*]

A.D. 1855, January 10.—N° 66.

BESSEMER, Henry.—" Improvements in the manufacture of " iron and steel." These commence at the refining process, the metal being run " from the finery furnace into large ingots or " moulds, having numerous partitions for the purpose of facilitat-" ing the breaking up of the metal into uniformly small pieces or " bars." Charcoal or coke may be used in the finery furnace, but " the process should be carried further than usual." These ingots are called " product No. 1." " When fine metal has been heated " in the puddling furnace until it is reduced to an incoherent " state, somewhat like sand, it may be removed from the furnace,

" and in this state constitutes product No. 2. The further working " of the iron and its formation into very small puddle balls, which " are rolled out of the furnace and allowed to cool." will produce what is called " product No. 3." By making bar iron from puddle balls of the usual size, and passing the bars hot through rollers having raised triangular ribs running lengthwise, uniform short pieces are obtained, called " product No. 4." Boiler plate parings, and similar scrap iron, form " product No. 5." These five products are used for conversion into steel. A furnace is used similar to a gas retort furnace, in which are placed a number of fire clay or other suitable retorts. These are divided into compartments by moveable plates connected to a series of iron bars, like buckets to a chain pump, and moved by a winding apparatus, so that the plates and materials contained in the compartments between them may be consecutively drawn through the furnace. " Into these chambers either of the products 1, 2, 3, 4, or 5 are " to be placed with charcoal powder between them." The partitions are advanced gradually every day, and for from six to twelve days the process of cementation is carried on, the materials being gradually carried through the heated retort or furnace; they are then cooled in an elongated part of the retort which protrudes from the furnaces, and is exposed to the cooling effects of the atmosphere. The result is a crude steel having the properties of blister steel. This is converted into cast steel in a reverberatory furnace, as described, with fluxes, as glass of borax, sal ammoniac combined with refuse glass, and other vitreous matters with charcoal. The steel may be melted in a cupola furnace, being first heated to a white heat in an attached retort or heating chamber, and gradually pushed into the cupola by a rake, or by other means. The fluid metal should be kept covered with a vitreous flux. The steel so made may be mixed with melted pig iron and with vitreous fluxes, either in the reverberatory furnace, or in the cupola with charcoal fuel.

[Printed, 1*s.* 5*d.*]

A.D. 1855, January 12.—N° 81.

HUNT, William.—" Improvements in the manufacture of iron." The application for Letters Patent was not proceeded with.

The Provisional Specification refers to the use of the oxide of iron *left as a residuum* from burning sulphuret of iron or pyrites, in making iron, and also steel. The oxide is to be ground and mixed with carbonaceous matter in the puddling process. It may also be used, mixed with oxide or chloride of manganese and carbonaceous matter, for making steel. Potash or soda or their salts are also used in the puddling furnace.

[Printed, 3*d*.]

A.D. 1855, January 13.—N° 93.

NEVILL, William Henry.—" Reverberatory furnaces for the " collection and condensation of volatile substances." In order to diminish the ill effects of rapid currents of air passing through the body of the furnace, the blast is applied to the fireplace " through twyeres placed nearly at right angles to and above the " fire bars." Three twyeres of 2½ inches diameter, with a pressure of 1¾ lbs. per square inch, are sufficient for 45 square feet of melting surface. It is desirable to have a layer of clinkers on the bars: a closed ashpit is said to be objectionable. Any system of flues and dampers and condensing chambers may be used, as may be found suitable.

[Printed, 3*d*.]

A.D. 1855, January 13.—N° 99.

PEARCE, John Charles.—" Improvements in machinery or " apparatus for the manufacture and working of iron and other " metals." The Specification describes a vertical steam hammer, having the steam cylinder placed low in the framing, and alongside of the hammer block, which is of considerable length, and has at its upper end a projecting arm to receive the upper end of the working piston. Or two steam cylinders may be used, with suitable valves, which are described. The object of this arrangement is to reduce the height of the machine and make it work in a small compass.

A particular kind of feed pump is described for feeding the boilers, having three cylinders in a line, the middle one for steam to actuate the others which are used for pumping.

[Printed, 2*s*.]

A.D. 1855, January 22.—N° 162.

GEDGE, John.—" Improvements in luminating metals in relief " *or bas-relief.*" (*A communication.*) The Specification describes machinery for laminating flat iron, brass, or steel, in which only one pair of cylinders are used; but any number of designs may be produced by keying on to the cylinders collars having engraved or raised surfaces on their peripheries, which impress a pattern on the metal passed between them.

[Printed, 10*d.*]

A.D. 1855, February 5.—N° 268.

DORRELL, JOHN.—" Improvements in machinery for pressing, " squeezing, and rolling iron." The application for Letters Patent was not proceeded with.

The Provisional Specification describes a curved bed formed partly of grooved bars with spaces between them, and placed between two side frames. A grooved roller works within the curved bed, which commences at a point below the roller, and somewhat forward of it, and proceeding upwards behind the roller comes beyond it in front. The position of the roller is adjustable, and may be placed nearer to, or farther from, the back of the bed. The entrance to the space between the roller and bed is wider than the other parts, and the iron being introduced is carried forward and compressed by the roller.

[Printed, 3*d.*]

A.D. 1855, February 6.—N° 279.

WARNER, ARTHUR.—" Improvements in coating, combining " sheet iron and steel with sheet lead, zinc, tin, copper, or alloys " of such metals." The application for Letters Patent was not completed.

Iron or steel in sheets may be combined with sheets of other metals by interposing soldering metal between them, and then heating and pressing the plates together.

[Printed, 3*d.*]

A.D. 1855, February 9.—N° 307.

LEES, JOHN, and HEAP, WILLIAM.—" Apparatus for cutting " and straightening bars of metal." The metal bars in a heated or cold state are cut with a circular saw, or other similar instrument, into proper lengths. The lengths are by means of self-acting apparatus delivered to a system of three or more rolls, by which they are straightened and stretched.

[Printed, 10*d.*]

A.D. 1855, February 13.—N° 333.

DALTON, GEORGE.—"Improvements in reverberatory furnaces." The application for Letters Patent was not duly completed.

The invention relates to constructing the ashpit of the furnace with air chambers at the back and sides, having numerous perforations or openings for the admission of air. These are connected with the ashpit, and supply the air in numerous streams, and so aid the combustion of the fuel.

[Printed, 3*d*.]

A.D. 1855, March 1.—N° 457.

JOHNSON, JOHN HENRY.—"Improvements in machinery or "apparatus for rolling and shaping metals." (*A communication.*) The application for Letters Patent was not proceded with.

The invention is stated in the Provisional Specification to relate to a rolling mill for making horseshoes, railway wheel tyres, and other curved articles by means of an ordinary plain roll "with a block "or plate running on a centre, and having a groove or slot formed "in its surface, corresponding in curvation and shape to the article "required." The bar is rolled at a red heat.

[Printed, 3*d*.]

A.D. 1855, March 3.—N° 472.

HUNT, WILLIAM.—Improvements in utilising compounds produced in the process of galvanising iron. These relate to the use of chloride of zinc instead of sal ammoniac in coating iron, and also to the use of a solution of chloride of zinc for steeping the iron in after being cleansed previous to being galvanised.

[Printed, 4*d*.]

A.D. 1855, March 10.—N° 540.

MICKLE, WILLIAM.—"Improvements in the production and "smelting of iron from its ore in blast furnaces." The application for Letters Patent was not duly completed.

The Provisional Specification relates to the use of coal gas, or other inflammable gas, which is to be injected in and among the charge of the blast furnace, by blast pipes, or other suitable means.

[*Printed, 3d.*]

A.D. 1855, March 13.—N° 563.

ILIFFE, Charles.—"Improvements in the manufacture of "metallic rods, bars, and tubes." The application for Letters Patent was not proceeded with.

The Provisional Specification relates to a mode of making iron tubes by casting a cylinder or billet in pig iron, or a mixture of pig iron and wrought-iron scrap. The cylinder is afterwards rolled out on a mandril. For bars or rods the billet is filled with cast iron, and then rolled.

[Printed, 3*d*.]

A.D. 1855, March 20.—N° 629.

ROGERS, Isaac.—"Improvements in the mode of heating iron "ore." The Specification and Drawings describe a revolving deoxydising cylinder," having a helical or screw-formed division heated from a reverberatory or other furnace, into which pulverised ore and carbon are introduced, the atmosphere being excluded. The charge is heated in any convenient manner, and "the carbonated ore drops away from the end of said cylinder into a "furnace to be immediately melted," and worked up in the ordinary way.

[Printed, 6*d*.]

A.D. 1855, March 20.—N° 630.

NEWTON, Alfred Vincent.—"Improved machinery for "forming moulds for casting." (*A communication.*) The sand is placed in "a chamber or piston box," and is moved therein by a "pattern and piston plate surrounding the said pattern." The sand is thereby caused "to protrude from the piston box and enter a half flask, by which means the sand at the parting is more compressed than at the central portion of the half mould."

[Printed, 9*d*.]

A.D. 1855, March 23.—N° 644.

BEHN, Charles Frederick.—"Improvements in machinery "for making moulds for casting." (*A communication.*) A rectangular box is used having a moveable piston arranged to receive the pattern, "which it raises into the half flask; together with the "sand to form the mould." The piston is so made that the pattern may descend into the piston before it descends itself. Two half flasks are used in making the mould, and half a mould is made at a time by placing the sand in the box above the piston.

[Printed, *7d.*]

A.D. 1855, March 24.—N° 651.

ELDER, David, junior.—"Improvements in moulding or "shaping metals." These relate to a mode of making moulds for casting pipes and other cylindrical forms. A pattern piece of short length is connected to a sliding frame, and used to form the mould. Suitable mechanism is also described for ramming the sand.

[Printed, 10*d.*]

A.D. 1855, April 4.—N° 753.

CROWLEY, John.—"Improvements in the manufacture of "malleable cast iron." The following mixture is employed:— 3 lbs. of chloride of sodium, 20 lbs. of wood, charcoal, or other carbonaceous matter, 28 lbs. of oxide of manganese, and 20 lbs. of carbonate of lime, are well pulverised and mixed with water. 12 oz. of the mixture and 8 oz. of wrought-iron scrap are made into a ball and dried. The ball with about 40 lbs. of charcoal made cast iron, such as Cumberland or Lorn iron, is put into a crucible and melted, and then cast into articles, which are annealed in the ordinary way.

[Printed, 3*d.*]

A.D. 1855, April 19.—N° 869.

CONGREVE, Charles Mc Ilvaine.—"Improvements in the "manufacture of iron, when oxide iron ores are used." (*A communication.*) The iron ores are reduced to small pieces and mixed with carbon; they are fed by a screw passing through a hopper into a slowly rotating heating cylinder. The ore and carbon are slowly moved from end to end of the cylinder by a spiral formed in its interior. The ores thus deoxydised descend into a reverberatory furnace, which may be placed in any suitable position relative to the cylinder, beneath, or at one end of it.

[Printed, 7d.]

A.D. 1855, April 21.—N° 899.

EDWARDS, William Alexander. — "Separating certain "metals from metallic substances." The application for Letters Patent was not proceeded with.

The Provisional Specification relates to a mode of separating iron and steel from other metals and ores, by means of a soft iron rod, which may be magnetised by an electric coil.

[Printed, 3*d.*]

A.D. 1855, April 23.—N° 906.

ZELL, Alfred Jenkin. — "Improvements in furnaces," &c. The Specification and Drawings describe a double furnace, wherein one fire is used for heating a calcining and a reducing furnace.

[Printed, 8*d.*]

A.D. 1855, April 25.—N° 932.

WILKIN, John Bryant.—"Improvements in stamping and "dressing or separating ores of any kind, &c." The application for Letters Patent was not proceeded with.

Stamping apparatus moved by cranks on the axle of a water wheel is used, with streams of water which carry down the ore into a tank, and wash away impurities.

[Printed, 3*d.*]

A.D 1855, May 4.—N° 1000.

DALTON, Daniel.—"Improvements in furnaces for the smelt-"ing iron ore and iron stone, and other stones and ores." A furnace is described having a chamber with a feed mouth at the top like a blast furnace, and having its lower part made in a hollow shape to receive the melted metal. The chamber is shaped like an inverted cone, and has on one or more sides a fireplace, where heat and flames pass towards and into the lower part of the chamber and melt its charge, and pass on into a flue which rises at the side of or surrounds the chamber. The flue may be dispensed with, and the flames and heat will pass up through the charge of the chamber.

[Printed, 8*d.*]

A.D. 1855, May 5.—N° 1006.

***BUTCHER,* Matthew, and NEWEY, Thomas Henry.**—"*Improvements* in forge hammers." These relate to a mode of fixing "the bray" or projecting part of the hammer, on which the projections of the rotating shaft act, by means of screws, which are adjustable. Between the screw and the head of the "bray" is a metal washer. The chair on which the fulcrum of the hammer moves is also made adjustable. Moveable metal or wood or vulcanised caoutchouc washers are employed under the chairs of the forge hammer.

[Printed, 7*d.*]

A.D. 1855, May 11.—N° 1066.

CADDICK, David.—"Improvements in puddling furnaces." A complete Specification was filed with the petition and declaration. It describes furnaces having "a wrought-iron plate on each back " and front side, extending from top to bottom and end to end of " the furnace, with suitable openings." The "tool boshes" have flues leading into upright flues formed in the angles of the shaft or chimney, to carry off the steam generated by the hot tools when put into water into the "tool boshes." A flue is made at the back of the puddling furnace leading to the flues outside the shaft, through which a rush of air passes, mixing with the steam generated in the tool boshes, and keeping the parts cool. The flue leading from the furnace to the shaft has a moveable iron bottom which may be removed to enable the flue to be cleansed. Suitable apparatus is attached to the furnace for throwing blasts of cold air on the hot bed when the charge is withdrawn, and so cooling it.

[Printed, 9*d.*]

A.D. 1855, May 14.—N° 1094.

LACKMANN, John.—"An improvement in the manufacture of " sheet iron." The Letters Patent became void, as no complete Specification was filed.

The Provisional Specification describes a mode of making sheet iron like "Russian sheet iron." The best quality of charcoal iron is chosen, and rolled into sheets in the ordinary way: the sheets are then annealed and singly or severally together are subjected to the process of planishing on a polished anvil by a polished hammer.

[Printed, 3*d.*]

A.D. 1855, May 24.—Nº 1174.

PUTNAM, SILAS SAFFORD.—" A new or improved forging machine." A complete Specification was filed with the petition. It describes a frame having four hammers, two working in vertical and two in horizontal grooves. The hammers are connected together by connecting rods, and work in pairs in such a manner that while the two vertical ones are urged to strike the upper and under side of an object simultaneously, the two horizontal ones are receding; and when these are urged towards each other to strike the object on opposite sides simultaneously, the vertical ones are made to recede. An object is thus hammered equally on all sides.

[Printed, 10*d.*]

A.D. 1855, May 26.—Nº 1207.

WATERHOUSE, THOMAS.—" Improvements in the means of " actuating forge and other bammers," &c. Forge hammers, actuated by compressed air, are constructed with cylinders or chambers having adjustable heads or pistons, whereby the space into which the air is compressed may be increased or diminished, thereby increasing or diminishing the expansive force of the air, and consequently the force of the blow produced. Suitable valves and apparatus are described for regulating and cutting off the supply of air.

[Printed, 1*s.* 1*d.*]

A.D. 1855, May 29.—Nº 1232.

JOHNSON, JOHN HENRY.—" Improvements in casting metals." (*A communication.*) The application for Letters Patent was not proceeded with.

The Provisional Specification relates to a mode of casting circular articles, as wheel tyres, hoops, &c. A circular chill or mould is made to rotate at a great velocity, and so form the interior shape of the article to be cast. The molten metal is poured into or near the centre of the rotating chill, and is driven by centrifugal force to the circumference, where it is allowed to cool. The top face or plate of the mould or chill is then removed, and the casting is withdrawn.

[Printed, 3*d.*]

A.D. 1855, June 5.—N° 1286.

NEWTON, William Edward.—"Improved machinery for "rolling bar iron" (*A communication.*) The application for Letters Patent was not proceeded with.

The Provisional Specification relates to rails for railroads which have "three treads or wearing surfaces, so that as the surfaces "become worn," by turning the rail one third round a new surface is presented, the other two surfaces providing a broad base or support. These rails are to be rolled by three rollers with their axes arranged in the lines of an equilateral triangle.

[Printed, 3*d.*]

A.D. 1855, June 6.—N° 1292.

HOPPER, George.—"Improvements in rolling and shaping "metals." These refer to the employment of swaging rolls of a peculiar shape for making the square and round portions of railway pins. The rolls have their grooves made with one portion semicircular, and the other V-shaped. As the rolls rotate in pairs while the semicircular parts of the upper and lower grooves are together, they form the circular aperture, and roll the circular part of the pin; when the V-shaped parts of the upper and lower grooves are together, they form a square aperture, and roll the square head of the pin.

[Printed, 7*d.*]

A.D. 1855, June 15.—N° 1365.

CLAY, William.—"An improved manufacture of bar iron." The patentee uses the machinery described in the Specification of his former Patent of December 16, 1848 (see N° 12,373, p. 95), for rolling in taper form, angle iron, T-iron, or bar iron, having a hollow or concave or convex surfaces in cross seection. The bar is thus made of greater thickness in the part where greater strength or rigidity is required.

[Printed, 6*d.*]

A.D. 1855, June 18.—N° 1384.

BESSEMER, Henry.—"Improvements in the manufacture of "cast steel and mixtures of steel and cast iron." Iron is prepared for being converted into steel by putting bar, hoop, or plate iron between a pair of slitting rolls, or granulated puddled iron may be used. The process of cementation is carried on in vertical tubes, retorts, or chambers, the centre portion thereof being exposed to the action of heat, the top and bottom parts being kept cool. The charge of iron and carbonaceous matter is put in at the top of the retort or tube, and as it descends it is heated by a furnace which acts on the middle part. When the contents of the lower part are withdrawn, the heated middle portion descends by its gravity past the middle or heated part, and is allowed to cool, while a fresh charge is introduced at the top. The process of cementation is thus carried on continuously. In some cases cementation is dispensed with, and in the puddling process the workman withdraws the iron when he, from its appearance, judges that it contains fully as much carbon as is contained in ordinary steel. Such puddled iron may be used alone, or with converted steel, and is melted in closed pots.

A circular furnace is described having a large cone in the centre for melting steel. The pots are placed in compartments ranged in a circle, each having a separate flue in the thickness of the walls of the cone. The pots are supported on hollow fire-clay stands, and have a tapping hole (by preference) in the bottom. A long fire-clay plug passes through the pot and its contents, entering by a hole in its lid; the plug may be moved from above by a pair of tongs, and so allows the metal to flow out. The tops of the compartments are level with the floor of the foundry, and the covers are supported on wheels running on circular rails. Below the floor is a cave, so that access may be had to the bottoms of the pots. By means of converging gutters the contents of all the pots may be collected to form one casting, the tapping of them all being performed simultaneously. The lids of the pots and the covers have holes excentrically placed (which may be stopped by stoppers) for introducing materials into the pots. Iron, either raw or in a molten state, may be melted with the steel. Where it is more advisable to use coal, the melting pots or retorts may be placed in a common reverberatory furnace behind the fire bridge.

[Printed, 1*s*. 9*d*.]

A.D. 1855, June 18.—N° 1388.

BESSEMER, Henry.—" Improvements in the manufacture of " *rolls,*" *&c.* The rolls are cast " in molten steel, or a mixture of " *steel and pig* or refined iron," in heated moulds. The rolls which are required to be solid are cast "with their axes entire." Those which are to be hollow are cored out, and provision made at their ends for the reception of a wrought iron or other axis.

[Printed, 4*d.*]

A.D. 1855, June 25.—N° 1450.

PAGE, John.—"Improvements in moulding or shaping metals." Articles of a cylindrical shape are cast by means of cores or core bars capable of being made to collapse or expand. The core bars are coated in a vertical mould box, which is enveloped in a steam chamber to dry the loam used.

[Printed. 10*d*]

A.D. 1855, June 27.—N° 1469.

LUCAS, Thomas.—"Improvements in the manufacture of iron." The application for Letters Patent was not proceeded with.

A blast furnace is proposed to be erected in connection with a puddling or refining furnace. The fused metal is made to flow directly from the blast to the refining furnace without detention, and without being exposed to the atmosphere, and is afterwards treated in the ordinary way.

[Printed, 3*d.*]

A.D. 1855, June 30. —N° 1493.

BIRCH, John.—"Improvements in the manufacture of iron." The Specification and Drawings, to which reference is necessary in order to understand the invention and the position of the tuyeres, describe a blast and refinery furnace combined, and having reducing tuyeres and also "oxidising tuyeres" placed near the bottom of the hearth, and oxidising blast pipes so as "to smelt and refine "at one operation." A refinery furnace is described which is separate from the blast furnace (but placed in its immediate neighbourhood), into this the metal is run from the blast furnace so as to "melt and refine at one heat." The use of coke for remelting the iron, as in the ordinary refining process, is dispensed with. "The air box and pipes are placed below the fire to blow direct "from the blast pipe," thereby dispensing with "pillars and "uprights."

[Printed, 9d.]

A.D. 1855, July 4.—N° 1503.

CLAY, William.—"An improved mode of manufacturing forged "iron." The object of the invention is to economise metal in making forged shafts and such articles. Lengths of wrought iron of a zigzag or other such sectional figure as will admit of their interlocking, are formed into a hollow cylinder, bound together, if requisite, by hoops. The cylinder is filled with sand, charcoal, dust, or other granulated substance to form a core, the ends are closed with plugs, and the whole heated to a welding heat, and welded under the hammer. Sometimes the sand core is dispensed with, the bars being so shaped as to support one another during the welding process.

[Printed, 6*d.*]

A.D. 1855, July 4.—N° 1505.

INGLIS, John, and COWIE, Archibald.—" Improvements in " moulding and shaping metals."—Moulds for cast-iron pots and such like articles are made by means of two distinct patterns, one shaped to the internal contour of the pot, and the other to its external contour.

[Printed, 7*d.*]

A.D. 1855, July 30.—N° 1730.

TRURAN, William.—" Improvements in smelting, and in " apparatus to be used therein." These relate to a mode of constructing nozzle pipes so that they deliver through one tuyere two or more jets of blast, hot or cold, of like or different densities. The nozzle pipes may be divided by partitions or be double, one being within the other, so that the outer one delivers an annular jet, and the two jets may be supplied from different pipes, and be of different densities or temperatures. Blast furnaces are described having the parts above the boshes of an area equal to or greater than the area of the furnace at the upper bosh line. These improvements enable iron ores of every description to be melted with raw coal. Clay and black band ores may be smelted without being calcined.

[Printed, 7*d.*]

A.D. 1855, July 31.—N° 1734.

MACKWORTH, Herbert.—"Washing and separating mineral "*substances,*" &c. Six processes are described for separating minerals of different specific gravities, as pyrites and shale from coal, &c. Currents of air and of water and other liquids of greater specific gravity, and vibrating tables or webs or sieves, are employed for this object.

[Printed, 1*s.* 2*d.*]

A.D. 1855, August 10.—N° 1810.

MICKLE, William.—" Improvements in smelting or produc-" ing iron from ore in blast furnaces."—In order to economise fuel and avoid the waste arising from the escape of gases from the blast furnace, the fuel, coal peat or wood, is separated, by the known processes in retorts, into coke and combustible gases. The latter are collected in a gasometer, and may be purified, or not, for use. The coke or charcoal is put in the blast furnace with the ore, and the gases are injected by suitable apparatus, provided with valves for regulating the supply, so constructed that the gas will pass only towards the furnace. If high heat be required, the gas and the air blast may be one or both heated. Furnaces having wide throats are preferred.

[Printed, 4*d.*]

A.D. 1855, August 23.—N° 1909.

MARTIEN, Joseph Gilbert.—" Improvements in preparing " certain oxydes of iron for use, and for apparatus to be used " therein." Oxydes of iron, such as furnace cinders, slags, and scales, are melted in a reverberatory or other suitable furnace. They are then " subjected to the action of streams of atmospheric " air forced into and among the melted mass by suitable blowing " apparatus, and the melted mass is also subjected to the action of " streams of steam passed into and amongst it, or to water forced " into and among the melted mass, by which much of the im-" purities chemically and mechanically combined will be separated, " and the oxyde or cinders rendered more beneficially useful for " the manufacture of iron therefrom." The resulting product will be a peroxide of iron in a porous or spongy state. " In place " of allowing the fluid mass after it has been run off from the " furnace to cool as a mass, it may be run into a receptacle, and " have streams of water or steam passed through and amongst it, " which will aid in granulating the matters, and keeping them " porous."

[Printed, 9d.

A.D. 1855, August 27.—N° 1940.

JOHNSON, William.—"Improvements in machinery or apparatus for rolling or shaping metals." (*A communication.*) Articles either perfectly cylindrical or conical, or of forms of varying diameters, may be rolled of the required shape by means of rolls of the contour required for the rolled article. Three rolls are employed; the two lower rolls rotate side by side in fixed bearings; the upper roll is carried in moveable sliding bearings which are moved up and down in the frame of the rolls by means of screws actuated by bevil wheels. The article, as for instance a railway axle, being laid on or partially between the lower rolls, the upper roll is pressed down upon it by means of the screws which move its bearings, and so give it by pressure the required shape.

[Printed, 7*d.*]

A.D. 1855, September 1.—N° 1975.

CALVERT, Frederic Crace.—"Improvements in the treatment of heating, puddling, and refining iron slags or cinders." The slags or cinders are mixed with lime, quick or slacked, or carbonate of lime, or limestone as used in blast furnaces, or magnesian limestone, and heated. The proportions preferred to be used with the slags are 15 to 20 per cent. of quicklime, or 20 to 30 per cent. of slacked lime, or 25 to 50 per cent. of the carbonate of lime or limestone. The lime may be heated with the slag by introducing it into the furnace after the iron has been removed, or it may be mixed with the lime and heated in a separate furnace. The slags and cinders so treated with lime will be more pure and more suitable to be used in the blast furnace or cupola than ordinary unprepared slags, and will produce better iron.

[Printed, 4*d.*]

A.D. 1855, September 3.—N° 1985.

CHANCE, James Timmins, and ADCOCK, Henry.—"Improvements in casting articles of the slags produced by the smelting of iron and other ores." Moulds made of moulders' sand are gradully dried and heated in suitable ovens to a red heat. The fluid slag is run into them while at a high heat, and they are left in the ovens for a considerable time, Instead of using vessels which require to be tilted to pour their contents, wrought-iron vessels are used with holes in their bottoms from which the pure melted slag is run into the moulds while the dross and scum are retained.

[Printed, 1*s.* 4*d.*]

A.D. 1855, September 5.—N° 2013.

MARTIEN, Joseph Gilbert.—"Improvements in roasting, "calcining, oxydising, and subliming metallic and mineral sub-"stances, and in the apparatus and means to effect the same." These relate to the employment of steam or streams of air to the mineral substances operated upon by means of perforated passages or pipes. A kiln is described having passages in the walls and hollow spaces for the introduction of numerous streams of air or steam, and the bottoms of reverberatory furnaces or ovens may be perforated and made hollow to effect the same purpose.

[Printed, 10*d.*]

A.D. 1855, September 15.—N° 2082.

MARTIEN, Joseph Gilbert.—"Improvements in the manu-"facture of iron and steel." Iron in a liquid state from the blast or the refinery furnace is purified "by means of atmospheric air or "of steam or vapour of water applied below, and so that it may "rise up amongst and completely penetrate and search every part "of the metal" prior to the liquid metal being allowed to set, or prior to its being run into the puddling furnace, whereby the manufacture of wrought iron by puddling and also of the manufacture of steel in the ordinary way are improved. The melted iron is conducted from the blast furnace by channels or gutters which are perforated, and streams of air or steam are passed through the fluid metal as it flows through the perforated channels or gutters. The refining process may be dispensed with, but if it be preferred to use it, the melted metal from the refinery is to be treated with streams of air or steam. Instead of using perforated gutters, the air or steam may be injected by using suitably formed moulds or beds.

[Printed, 3*d.*]

A.D. 1855, September 15.—N° 2085.

HILL, David.—"Preparing a material capable of resisting fire-"and especially suitable for the interior of puddling and oth

" furnaces." Limestone and ironstone or cinders from the puddling, ball, or mill furnaces are melted together, and form a fire-resisting material. The proportions recommended are, limestone $\frac{1}{6}$ and ironstone $\frac{2}{3}$, these are melted together and run into moulds of suitable shape, and used for making the interior of the furnaces.

[Priuted, 3*d.*]

A.D. 1855, September 15.—N° 2094.

FORSYTH, THOMAS.—"Improvements in the treatment of scrap " iron in the process of manufacture." The application for Letters Patent was not proceeded with.

Ordinary wrought-iron scraps are to be cleansed by burning off all impurities before the scrap is piled for being welded. This process produces sounder iron than is produced from uncleansed scraps.

[Printed, 3*d.*]

A.D. 1855, September 20.—N° 2119.

PAGE, JOHN, and ROBERTSON, WILLIAM.—" Improvements " in moulding and shaping metals." Moulds for casting hollow ware shells or shot and such like articles are made by a machine which has a cutting or scraping out, and also a stamping or pressing motion. The moulds are made by first partially ramming them and cutting or scooping out portions of the mould material, leaving a thickness greater than is ultimately required, which is afterwards pressed down to a proper size by a suitable pattern.

[Printed, 1*s.* 3*d.*]

A.D. 1855, September 24.—N° 2135.

NEWTON, ALFRED VINCENT.—" An improved mode of casting solid and other articles in metal." (*A communication.*) The process of casting is so carried on that the filling of the mould with metal and the contraction by cooling shall take place simultaneously. A mould is described made of segments of perforated fire brick in such manner that passages are left for the introduction of cooling streams of air or water, and for introducing the molten metal, which is led in from an elevated reservoir "which " supplies it at a pressure that will ensure the filling up of the " mould as the metal contracts therein by reason of the rapid " abstraction of heat from the metal."

[*Printed*, 10*d.*]

A.D. 1855, September 27.—N° 2152.

FONTAINEMOREAU, P. A., Le Comte de. — "Improvements in forging iron." (*A communication.*) The hammering or welding of the iron is performed by a hammer working in the interior of the furnace to prevent the cooling effect which takes place in the ordinary mode. A vertical steam hammer is described which passes through the furnace, being actuated from without, above it, and an anvil projects into the furnace from below, being supported on a block outside. The iron is thereby supported in the furnace, and hammered without being withdrawn.

[Printed, 6*d.*]

A.D. 1855, October 1.—N° 2189.

UCHATIUS, Franz. — "An improvement in the process of "manufacturing cast steel." Pig iron "of the purest quality" is melted in a suitable furnace, and "while in a molten state" it is "run into cold water," and thereby reduced "to granulated iron." This is mixed with about, "say, 20 per cent. of roasted pulverised "sparry iron ore, and 4 per cent. of fire clay," and placed in fireclay crucibles, and heated in a common cast-steel blast furnace. By subjecting granules of iron in the presence of sparry iron ore to a melting heat, "the enwrapping oxides will first effect a partial "decarbonization of the granulated iron, which decarbonization "will be limited in amount according to the size of the granules "operated upon, and by reason of the continued application of "heat the iron will melt and separate (with the assistance of the "melting residues of the sparry iron ore) from the impurities with "which it was mixed, and also bring down with it a portion of the "iron contained in the sparry iron ore, thereby increasing the "yield of cast steel about 6 per cent." The manipulations of melting and casting are the same as are ordinarily employed. The finer the iron is granulated the softer will be the resulting steel. "The softer sorts of welding cast steel may be obtained by an addi-"tion of good wrought iron in small pieces," and harder qualities by adding charcoal to the mixture described. Other substances yielding oxygen gas may be used so that the granulated iron be subjected in crucibles to "the combined action of oxygen, heat, "and fluxes."

[Printed, 8*d.*]

A.D. 1855, October 5.—N° 2229.

HOWELL, Joseph Bennett.—" Improvements in the manu-" facture of steel castings for ordnance and other purposes." The application for Letters Patent was not proceeded with.

The Provisional Specification describes a mode of making ingots or blocks of cast steel for ordnance and other purposes, with an iron centre. A bar of hot iron covered with a deoxydizing agent is placed in the centre of the mould. The deoxydising agent removes the oxide from the bar, and the fluid steel is poured in and comes into direct contact with the iron, and so perfect cementation is obtained. The use of this bar of iron will lessen the cost of boring ordnance, and contribute to complete soundness during the process of forging.

[Printed, 3*d*.]

A.D. 1855, October 9.—N° 2250.

MARTIEN, Joseph Gilbert.—" Improvements in the manu-" facture of iron and steel." The puddling cast iron with or without other matter into malleable lumps of spongy iron being well known, this invention relates to a mode of purifying such spongy lumps of malleable iron. This is effected by immersing them while hot from the furnace in water. To the water may be added chlorine or saline or alkaline matters, making the crude iron produce better wrought iron or steel, for which purpose the lumps should have a surplus of carbon. The sponge iron may also be subjected to the action of steam, in a suitable vessel. The purified sponge may be melted directly into cast steel alone, or with suitable fluxes in the ordinary melting pots.

[Printed, 4*d*.]

A.D. 1855, October 16.—N° 2312.

FORREST, John.—" An improved mode of extracting metals " from their ores." The ores referred to are those of the precious metals, which are broken small and immersed in a hot alkaline bath.

[Printed, 3*d*.]

A.D. 1855, October 17.—N° 2321.

***BESSEMER*, Henry.**—" Improvements in the manufacture of " *cast steel.*" These consist in "forcing currents of air or of

" steam, or of air and steam, into and among the particles of " molten crude iron, or of remelted pig or refined iron, until the " metal so treated is thereby rendered malleable, and has acquired " other properties common to cast steel, and still retaining the " fluid state of such metal, and pouring or running the same into " suitable moulds." A furnace is described suitable for carrying the process into practical operation. It consists of a long rectangular chamber, whose mouth is level with the foundry floor. The bottom of the furnace is formed into a ridge, and below it is a cave to which access is given to the workmen. The central part of the ridge is flattened, and has openings for the reception of the melting pots; these have holes in their bottom, and when tapped the metal flows into moulds supported in the cave below on a carriage, or in any other convenient way. The fire bars are arranged in the vertical sides of the furnace, not in the bottom. This prevents their being liable to become clogged up. Air for combustion may be supplied by a chimney draught, or by compression from a blowing fan; in the latter case the cave is made as air-tight as possible, and access is given by means of a valve door revolving in a cylindrical casing. The pots are heated before being used in the furnace, where they rest on suitable iron supports. The pig iron intended to be converted is melted in a cupola or finery furnace, erected at a convenient distance, and is poured in a fluid molten state into the crucibles, and then raised to a still higher temperature. Above the furnace is fixed an iron pipe covered with brick, or other non-conductor of heat. From this main pipe other moveable sliding pipes branch off, one for each pot. Steam or air, at a suitable pressure (and, by preference, heated to a high temperature), is conveyed from the main pipe by the branch pipe down to the bottom of each pot, and is forced up among the particles of metal it contains. By preference steam is used at first, for about one third of the time required for the operation, and air afterwards; the operation takes up generally from twenty to forty minutes. Steam cools the metal, but air causes a rapid increase in its temperature, and it passes from a red to an intense white heat, and a violent ebullition ensues. When the iron is sufficiently decarbonized, the pipes are raised, the pots tapped below, and the converted metal is run into moulds placed in the cave. The process is continued for a longer time in proportion, as a milder steel is required. If the iron becomes pasty in the pots, the pipe is withdrawn, and the temperature is raised by greater heat being applied. Steam and air may be used together, but it is preferred to use them separately.

[Printed, 1*s.*]

A.D. 1856, October 24.—N° 2378.

HEALEY, John, and LOWE, John. — " Improvements in " machinery to be used for drawing, moulding, forming, and " forging various articles of metal."

The Specification describes rolls having bell-mouthed guides, and also stops to arrest the motion of the article rolled. The rolls may be made to approach or recede from each other by screws or inclines acting on the steps of the journals of the upper and lower rolls.

Also, forge hammers or rams are described, which are actuated by the adhesion of contact of revolving pulleys or rollers, having portion or portions of the peripheries removed, and having springs to regulate the force of the percussion.

[Printed, 11*d.*]

A.D. 1855, October 30.—N° 2419.

NAYLOR, William.—" Improvements in power hammers," &c. The Specification and Drawings, which require to be consulted, describe an improved arrangement of valves and valve gearing and pistons applied to forge and other hammers worked by elastic gas, steam, or compressed air.

[Printed, 1*s.* 8*d.*]

A.D. 1855, October 30.—N° 2421.

HOCROFT, Thomas, and FORREST, Richard.—" Improve- " ments in the manufacture of iron rods," &c. The application for Letters Patent was not proceeded with.

Iron bars are to be piled, then rolled into one bar; this is slit into rods which are passed at the same heat through rolls, having grooves of any required section. By varying the grooves various descriptions of iron may be produced, as two lengths of hoop and one of round simultaneously; by these means the " bolting and breaking-down processes " are avoided, and many heatings are saved.

[Printed, 3d.]

A.D. 1855, November 7.—N° 2526.

HAMPTON, Charles Joseph.—"Improvements in the manu-"facture of iron." A caustic alkali or alkaline salt is dissolved in water, by preference, 8 oz. of alkali, as potash, in 1½ lbs. of water, with this solution about 3 lbs. of quicklime are saturated. The mixture is introduced either alone or combined with other matters, as oxide of iron or manganese, into a puddling or refining furnace, and being mixed with the charge of iron of about 5 cwt. it fluxes the impurities combined with the iron.

[Printed, 3*d*.]

A.D. 1855, November 1.—N° 2439.

TAYLOR, William.—"Improvements in the manufacture of "iron." The iron is puddled in the usual way until it acquires a semifluid or pasty consistence. It is then discharged from the puddling furnace, by a door placed in the back, or in any other convenient position, into a vessel of water, where it is cooled in the shape of a spongy mass. This is then pulverised by rolling or stamping, and sifted into powders of varying fineness. Each sort of powder is separately treated in a furnace and balled into balls of suitable sizes, which are hammered into blooms. The finest powder will produce the best iron.

[Printed, 3*d*.]

A.D. 1855, November 16.—N° 2585.

EASSIE, William.—"Improvements in hammers." A vertical hammer, called a "friction hammer," suitable for forging or crushing metals, &c., is described, and is worked by steam or other power. The hammer head is attached to a vertical bar raised by means of a pair of friction rollers acting on opposite sides of the bar, and allowed to fall by its own weight when disengaged from the friction rollers. The rollers are mounted in a frame "working radially," round a centre in a line with the axis of the bar. By depressing a handle the roller frame is moved round through a portion of a circle, the friction rollers are pressed against opposite sides of the bar, one above, the other below the axis of the roller frame. The rollers are both made by suitable apparatus to revolve in an upward direction, and being caused to nip the vertical bar, raise it to the required height. The handle is then raised, the friction rollers are separated, and the hammer is disengaged and allowed to fall. The hammer may be made self-acting by the action of an incline, in combination with suitable levers, rods, and stops.

[Printed, 8*d.*]

A.D. 1855, November 16.—N° 2590.

PRINCE, Frederick.—" Improvements in the manufacture of " cast iron." The application for Letters Patent was not proceeded with, as the law officer refused provisional protection.

The Provisional Specification was as follows :—" These improve-" ments consist in combining with cast iron certain proportions " of other metals not heretofore employed in combination, more " particularly in the manufacture of ordnance and fire-arms; said " improvements being designed for the purpose of giving to cast " iron greater tenacity, and rendering the same more homogeneous " throughout than heretofore."

[Printed, 3*d.*]

A.D. 1855, November 20.—N° 2618.

PRICE, David Simpson, and NICHOLSON, Edward Chambers.—" Improvements in the manufacture of cast iron." Cast iron of a superior quality and strength, suitable for casting ordnance, girders, &c., may be produced by melting together any kind of grey pig iron, and refined iron usually called " metal," or "finers' metal," or "refinery metal," the object being to lower the per-centage of silicon in cast iron while the total amount of carbon remains the same. If iron ores be smelted under similar circumstances, except that in one case hot blast, in the other cold blast be used, the hot blast iron will contain a larger amount of silicon and less carbon than cold blast iron. Iron smelted with charcoal contains less silicon and sulphur than iron smelted with coal or coke. The product obtained by melting grey pig iron with finers' "metal" is found to be freer from impurities, especially silicon than charcoal or coke iron, while it contains about the same per-centage of carbon as the pig iron from which it was made. The per-centage of silicon depends on the relative proportions of the " metal " and pig iron used, and iron " either " grey or mottled " can be produced, according to circumstances, by varying these proportions. By melting coal or coke iron with the " metal," a cast iron, having as regards silicon the composition of charcoal iron, is obtained. By melting charcoal iron with "metal" made from the same, a cast iron of exceeding purity is produced. The pig iron recommended is that "smelted by cold "blast from spathic, argillaceous hœmatite, or magnetic oxide "ores" alone, or mixed, the object being to avoid too great an amount of impurities. The "metal" made from cold blast pig iron from the ores referred to, is preferred; it should be refined until it has lost the whole or nearly the whole of its silicon with as little carbon as possible.

[Printed, 3*d.*]

A.D. 1855, November 20.—N° 2619.

PRICE, DAVID SIMPSON, and NICHOLSON, EDWARD CHAMBERS.—"Improvements in the manufacture of cast steel." Cast steel is economically produced by melting what is called "metal" or "finers' metal," or refining metal with suitable proportions of wrought iron, in any convenient form, or obtained by any convenient process. The metal recommended to be used is that made from "pig irons melted with a cold blast from hœmatite "or spathose ores," and refined until it has lost the whole or nearly so of its silicon with as small a proportion of carbon as possible.

[Printed, 3*d.*]

A.D. 1855, November 24.—N° 2653.

SANDERSON, CHARLES.—"An improvement in the manufac-"ture of iron." Iron is refined and purified by mixing with it in a fluid state in a reverberatory furnace "some suitable metallic or "non-metallic salt, capable of disengaging oxygen when decom-"posed." Sulphate of iron is recommended: from 20 to 40 lbs. of it may be mixed and stirred up with about a ton of pig iron. For mottled forge iron 20 lbs., for grey iron 30 lbs., for No. 1 foundry pig iron 40 lbs., will be beneficial proportions to add to a ton of melted iron. "The sulphate of iron or other chemical "reagent should be allowed to act upon the fluid iron for about "one hour." The operation is completed when the iron becomes thick or creamy. The furnace is then tapped into a suitable receptacle, so that the refined metal may separate itself by gravity from the dross and impurities, and iron of superior quality is the result.

[Printed, 3*d.*]

A.D. 1855, November 30.—N° 2704.

HANCOCK, Richard.—" Cleaning and separating ores," &c. An arrangement of tables and brushes is employed in connection with a stream of water for washing and separating pulverised ores, especially those of the precious metals.

[Printed, 9*d*.]

A.D. 1855, December 7.—N° 2768.

BESSEMER, Henry.—" Improvements in the manufacture of " iron." Iron is refined after it leaves the blast furnace and while still in a fluid state, by running it in a molten state into a suitable vessel, (by preference, of a spherical or egg shape, or such shape as will present as small a surface as possible for the radiation of the heat,) and forcing up through it currents of air or steam. The vessel may be made of cast, or, by preference, of wrought iron lined with fire brick; it is suspended on axes and closed at the top, having two or more openings left for the introduction of a pipe for a blast of air or steam, and also for the molten fluid, and to admit of the escape of gases and sparks while the blast is being forced through the molten iron. The vessel is placed near the blast furnace, and should be of such dimensions as to be nearly filled with its charge. As soon as the iron is let in the vessel, which is by preference previously heated, currents of air or steam, or both, by preference air highly heated, are introduced by a pipe passed nearly to the bottom of the vessel, and are forced up through the metal, and the oxygen thus introduced will combine with and carry off a large portion of carbon and the impurities. When the process has been carried far enough, as indicated by the lessened fluidity of the iron, the vessel is turned on its axis, and by a suitable lip is poured into an iron mould, having compartments to form ingots suitable for being puddled.

Secondly, for completing the refinement of the iron, a reverberatory or puddling furnace is used, such as is described, having a deep hearth with holes in the sides, through which pipes are introduced, and thereby blasts of hot air or steam are forced into and among the fluid iron, or the ends of the pipes are inserted in the fluid iron and air forced up through it. The workman stirs the iron in the usual way and balls it, and it is then made by squeezing, hammering, &c., into bar iron.

Thirdly, to ensure the iron being made as free as possible from impurities, retort furnaces, as described and shewn in the Drawings, are recommended to be used. In these the iron is melted and treated with air or steam in closed retorts, as before described. The iron is either put in the retorts directly from the blast furnace, or crude or refinery iron is put therein, and melted with suitable fluxes.

These methods are adapted to the processes and apparatus already in use in manufacturing iron, but except in cases of adaptation it is recommended as expedient to carry out "the refinement of pig or crude iron by a single process, and cast the same "into ingots suitable for rolling at once into bars or rods." For this purpose an air furnace is used, having a fire clay or black lead crucible, capable of containing several hundredweight of iron. It has a dome-shaped top, with openings for supplying metal and introducing the blast and a tapping hole at the bottom. The furnace having been got up to its full heat is about three fourths filled with fluid iron, by preference, from the blast furnace; a pipe is then inserted down into the metal, and currents of air or steam, or both, by preference heated, are forced into and among the fluid metal. After about 15 or 20 minutes great augmentation of heat and flame is produced with violent ebullition, and much slag is discharged through the openings provided for that purpose. Afterwards the action diminishes, and as it subsides indicates when the process is completed, and the metal may be run out into ingots, by preference of a large size, requiring much rolling, which affords a fibrous texture without "piling." It is preferred, if steam is used, to use it in the early stage only. The currents of air subsequently used cause increased heat and keep the iron fluid, but if it becomes pasty the heat of the furnace is to be raised. In this process the manipulation in the puddling process is dispensed with, and the metal passes from the state of crude iron by a single process to the condition of pure or nearly pure malleable iron. The whole mass of iron, however large the ingot may be, is said to be of the same homogeneous quality throughout, and free from the impurities mixed up and worked with iron in the ordinary puddling process.

The processes described are applicable to the manufacture of bar iron, and may also be used with iron intended to be founded or *cast into various* shapes. Refined iron that is intended to be used *for casting* may be deprived or nearly so of its carbon, and castings, capable of being forged or rolled, will be produced. When the castings are required to contain a large quantity of carbon it is refined in the manner before described, and carbonaceous matters, as wood, bituminous shale, or carburetted gaseous matters, are mixed with the fluid metal. In passing currents of air or steam through fluid iron, matters found beneficial may be introduced with the currents in a powdered state, as carbonate of soda or potash, to separate silica. The iron may be melted in a cupola or blast furnace, and then be refined in a ladle or crucible to any desired extent, and be then run into the mould; or it may be so refined and deprived of carbon as to be difficult to pound, carbon is then added by thrusting a billet of dried wood, or other carbonaceous matter, into the fluid metal, which produces rapid ebullition, and imparts the desired quantity of carbon to the iron.

[Printed, 1*s.* 8*d.*]

A.D. 1855, December 15.—N° 2839.

CLAY, WILLIAM.—" Improvements in the manufacture of bar " iron." Rolling pressure is employed for making bar iron of various shapes and sectional figures, as straight, square, or angle iron, or T or channel grooved bars, into taper bars whose sectional areas increase or diminish gradually from one point to another in their length, so that at any given point thickness, rigidity, and strength is obtained, as may be found desirable. This is effected by a different mode from that described in a former Patent, dated December 16th, 1848, see N° 12,373, p. 95, where a rising top roll is employed.

The rolls are set apart to the greatest distance required for the taper bar, and the requisite indentations or depressions are given by means of an iron or steel plate of the requisite shape, which is placed cold over the heated bar, and the two are passed together between the rolls. The cold taper plate acts as a filling piece and leaves a counterpart impression of the required shape on the hot bar. If the taper shape is to be given to the hot bar on both sides, it is rolled between two cold pressure plates suitably shaped.

[Printed, 3*d.*]

A.D. 1855, December 15.—N° 2841.

CLAY, WILLIAM.—" Improvements in the manufacture of iron."
The application for Letters Patent was not proceeded with.

The Provisional Specification states that the "invention consists "in taking crude or cast iron in a melted state, and reducing it "to a granular form, in which state it will be found much more "convenient for conversion by the subsequent ordinary processes "into iron."

[Printed, 3*d*.]

A.D. 1855, December 17.—N° 2854.

FONTAINE, Jean Jacques.—"Improvements in the manu"facture of steel." The application for Letters Patent was not proceeded with.

Cast iron is to be converted into steel by melting it in a pot or crucible; currents of heated air, alone or mixed with chlorine or hydrochloric acid gas, are passed over the surface of the iron. A mixture of cast iron, scale, peroxide of manganese, and chloride of potassium, magnesium, calcium, strontium, or barium, or hypochlorite of potash, soda, lime, magnesia, strontia, or baria, may be then added. Instead of using a melting pot the iron may be melted and treated in a reverberatory furnace.

[Printed, 3*d*.]

A.D. 1856.

A.D. 1856, January 1.—Nº 3.

CALVERT, John.—"Improvements in extracting metals from "their ores." The application for Letters Patent was not proceeded with.

The improvements are stated in the Provisional Specification to consist in the application of electricity "to facilitate the decomposition and extraction of metals."

[Printed, 3*d*.]

A.D. 1856, January 2.—Nº 10.

TILGHMAN, Richard Albert.—"Improvements in the manu-"facture of iron." Common salt, by preference, in a dry powdered state, is introduced by blast pipes into the furnace at its hottest part. The quantity of salt recommended to be used is about three per cent. by weight of the iron; but the more sulphurous are the materials used the larger must be the quantity of salt should be employed.

[Printed, 3*d*.]

A.D. 1856, January 4.—Nº 44.

BESSEMER, Henry.—"Improvements in the manufacture of "iron and steel." The object of the invention is the more perfect refinement of iron. To effect this the iron is "exposed in a more "divided or extendedform to the intense heat of the furnace," as described, and "to the oxydising action of a blast of air, by keeping "such fluid metal in motion, and continually bringing fresh por-"tions of it in contact with oxygen and with intensely ignited "fuel, or with the highly heated interior surface of the furnace, "the metal being thus kept in a fluid state until the desired "amount of decarbonization or refinement is arrived at." Several kinds of furnace are described in the Specification and Drawings, into which the iron may be run in a fluid state directly from the blast furnace, or it may be introduced in any other convenient form.

The first arrangement of furnaces consists of a series of small *cupola furnaces* ranged one below the other on a series of steps, so that the iron melted in the upper cupola may flow down into the lower ones successively. The fluid metal is conducted by suitable gutters, and is allowed to fall in a divided form from the upper cupola through the highly heated fuel and the blasts of air of the next lower cupola, and the operation is repeated until it reaches the lowest, where the refined metal is tapped.

In a second modification two cupolas are placed side by side, each connected with elevating apparatus on the principle of a ram. When one cupola is elevated, the fluid metal is run from it by a suitable spout into the lower one, and falls in a shower through the ignited fuel and blast of air of the lower one, which is then raised in turn; and the operation is repeated as required. Or the iron is melted in cylindrically-shaped furnaces made of plate iron lined with brick and loam. These are made to revolve vertically or horizontally, and the fluid iron and ignited fuel are thoroughly stirred up while blasts of hot or cold air or steam are forced through them. The usual fluxes and purifying matters may be mixed with the iron. The process of refinement is carried to any desired point, and may be arrested at any stage. When steel of a superior quality is required, the refinement of the crude iron is carried as far as possible, and soft iron is produced, which is cast into ingots or rolled into bars and cemented in the usual way, and worked up into steel.

[Printed, 1*s.* 6*d.*]

A.D. 1856, January 23.—N° 174.

ONIONS, JOHN.—"Improvements in the manufacture of iron." The application for Letters Patent was not proceeded with.

Smoke, heated air, and inflammable gases, with or without finely pulverized fuel, are injected into the blast furnace through the tuyeres or other suitable openings, so as to be consumed while being forced through the melted mass of metal in the furnace.

[Printed, 3*d.*]

A.D. 1856, January 25.—N° 205.

BROWN, GENTLE.—"An improvement in the manufacture of "cast steel." Bar iron, cut or clipped into small pieces, is mixed with good charcoal pig iron, in the proportions of about one part pig iron to three parts of clipped bar iron. This combination of metals is melted and run into ingots, producing cast steel suitable for various purposes. For edge tools, ten pounds of pig to thirty pounds of bar iron; for table knives, eight pounds of pig to thirty-two pounds of bar iron; for hard steel, twelve pounds of pig to twenty-eight pounds of bar iron, are proportions recommended.

[Printed, 3*d.*]

A.D. 1856, January 29.—N° 245.

POPE, ABRAHAM.—"Improvements in the manufacture of iron, copper, tin, and lead." Hœmatite or other iron ore, as free as possible from sulphur, is melted with anthracite coal or charcoal, and carburetted anhydrous silicate of alumina, the residuum left from the distillation of boghead coal or bituminous shale.

Full directions as to the proportions and time necessary for the operations are given for the manufacture of iron and the other metals.

[Printed, 4*d.*]

A.D. 1856, January 29.—N° 246.

BERGEVIN, AUGUSTE MATTHIEH MAURICE DE.—"Improve-" ments in preparing coal for burning, and in furnaces," &c. The Letters Patent became void, as no complete Specification was filed.

The Provisional Specification states that the coal is to be prepared by placing it in a solution of bicarbonate of soda, nitrate of potash, or other salts, and then dried, forming suitable fuel for furnaces for steam boilers, and for refining iron. The furnaces should have two sets of bars, the upper presenting a larger area than the lower. and numerous streams of air should be forced among the fuel. By these means the coals may be burned without smoke.

[Printed, 3*d.*]

A.D. 1856, February 5.—N° 307.

THOMAS, GEORGE CUMMINS.—"An improved method of hardening and tempering steel." (*A communication.*) A finely pulverized compound, consisting of chloride of sodium, about twenty-one parts, bichromate of potash, eight parts, and prussiate of potash, eight parts, is applied to the steel when heated. The sodium may be used with sixteen parts of the bichromate or the prussiate of potash. The steel in various shapes (as that of cutting tools with a square edge) is heated to a dull red, and may then be *either sprinkled* with the compound or dipped into it, and then *heated in the* fire to a high cherry red; the higher the heat the harder the steel becomes. The articles may be dipped in the compound and reheated as often as required, and then dipped in water and cooled. Bevelled edged tools should be slowly heated, and the compound be carefully applied to the steel parts. Thin edged tools should not be heated above a blood red heat, and be cooled in salt and oil.

[Printed, 3*d*.]

A.D. 1856, February 12.—N° 356.

BESSEMER, Henry.—" Improvements in the manufacture of " malleable or bar iron and steel." " Molten crude iron or remelted " pig or finery iron " is converted " into steel or into malleable iron " without the use of fuel for reheating or continuing to heat the " crude molten metal, such conversion being effected by forcing " into and among the particles of a mass of molten iron currents " of air or gaseous matter containing or capable of evolving sufficient " oxygen to keep up the combustion of the carbon contained " in the iron till the conversion is accomplished." The melted iron is run into a vessel such as is described, being made of iron lined with fire brick, and provided with suitable openings for introducing through the tuyeres the blast of air (heated, or by preference cold, as being cheaper) below the fluid metal, and also for allowing slag and impurities to flow over. The patentee states that he discovered " that if atmospheric air or oxygen is thus ntro- " duced into the metal in sufficient quantities it will produce a " vivid combustion among the particles of fluid metal, and retain " or increase its temperature to such a degree that the metal will " continue fluid during its transition from the state of crude iron " to that of cast steel or malleable iron, without the application of " any fuel, the requisite high temperature by such mode of action " being obtained by the oxygen uniting with and causing a com- " bustion of the carbon contained in the crude iron, and alse " by the combustion of a small portion of the iron itself." Tho vessel is filled rather less than half full of molten iron, and as the air is blown into the metal under a pressure, at least, equal to the weight of the column of metal to be displaced, its temperature rises, violent ebullition ensues, and in about fifteen minutes frothy slag with sparks and flames is driven off through the opening provided for that purpose; in a few minutes this subsides, but flames continue to escape, and by their appearance the workman learns by experience when the conversion is completed. He also tests the iron by pouring some from the vessel. The operation is arrested at the point when the metal is purified and decarbonised to the required extent, and it is then brought into the state of hard or soft cast steel, or by continuing the operation five or ten minutes longer into that of malleable iron. If the temperature is found to be too excessive, the metal should be cooled before it is poured into ingots. If the ingot is found to be porous, it is heated to a welding heat and hammered or squeezed. A squeezing apparatus with grooves or hollows to hold the ingot conveniently is described. Also a steam hammer for a similar purpose is described. If the upper ends of the ingot are unsound, they may be broken off and remelted.

If it be desired to obtain steel of a very superior quality, the iron refined by the above process is granulated by being poured into water, and is then converted by the cementation process described in the Specification of a former Patent, dated June 18, 1855. See N° 1388, p. 196.

[Printed, 1*s*. 6*d*.]

A.D. 1856, February 12.—N° 359.

BROOMAN, Richard Archibald.—"Improvements in the "manufacture of cast steel." (*A communication.*) Any description of iron, however poor, may be converted into good, tenacious, malleable, and welding steel, by melting it in pots with compounds of cyanogen and sal ammoniac. With fifty pounds of iron the following ingredients, ten ounces of charcoal, six ounces of common salt, half ounce of brickdust or oxide of manganese, an ounce of sal ammoniac, and half an ounce of ferrocyanide of potassium are mixed, and the composition is melted in a pot. The metal is mixed with the compound and melted in a crucible, being kept at a great heat for about three hours. It is then run into ingots, and may be worked up in the usual way.

[Printed, 3*d*.]

A.D. 1856, February 26.—N° 495.

PARRY, George.—"An improvement in the puddling and "refining of iron." The iron in a molten state is subjected to the action of superheated steam in a puddling or reverberatory furnace such as is described. The steam is forced down upon the surface of the iron while it is stirred with the "rabble;" when the iron becomes thick and pasty, the steam is turned off, and the "heat of iron" may be finished in the usual way.

In refining iron, the superheated steam may be injected below the surface of the fluid metal, which may be run out into water and granulated and worked up into steel. If a superior quality of metal is required, two per cent. of pipe clay is added about five minutes after steam has been turned on, and soon after from ten to fifteen per cent. of calcined spathose iron ore or sparry carbonate of iron may be added in powder.

[Printed, 7*d.*]

A.D. 1856, February 28.—N° 510.

MARGESSON, PHILIP DAVIES.—"Improvements in the manufacture of iron from iron ores." The application for Letters Patent was not completed.

The Provisional Specification states that calcined ores in a powdered state are to be placed in a furnace with powdered carbonaceous matter, fluxes, fuel, &c. The fire is to be lighted at the top, and made to burn downwards by a blast driven down upon it.

[Printed, 3*d.*]

A.D. 1856, February 28.—N° 515.

GROSRENAUD, PIERRE LOUIS.—"Improved furnaces for melting and puddling metals."

The Specification and Drawings, which should be referred to, describe a furnace provided with one or more elongated crucibles or melting pots, also a reverberatory furnace for manufacturing steel and iron.

[Printed, 1*s.*]

A.D. 1856, March 1.—N° 535.

MOTAY, CYPRIEN MARIE TESSIE DU, and FONTAINE, JEAN JACQUES.—"Improvements in treating cast iron." Cast iron is purified and decarbonised simultaneously, either in puddling or refinery furnaces, and is converted into wrought iron, having the properties of steel, by the use of certain fluxes prepared as described. First, common scoria and silicate of alumina are melted together; to this flux during its fusion are added, first, a bicarbonate of potass or soda; secondly, a silicate of the protoxide of iron, or other anhydrous silicate. Or with the silicates of alumina are combined silicates of alkalies, or alkaline earths or metallic oxides. A great variety of other chemical agents are also mentioned as suitable for being used in the puddling or refinery furnaces.

[Printed, 4*d.*]

A.D. 1856, March 7.—N° 571.

HÄHNER, Guillaume.—"Improvements in treating ores." (*A communication.*) Metallic oxides, and especially the oxide of copper, are decomposed at a high temperature, in the presence of vapours of water and silica, by means of alkaline or other chlorides.

[Printed, 3*d.*]

A.D. 1856, March 15.—N° 630.

BESSEMER, Henry.—"Improvements in the manufacture of iron and steel."

The Specification referring to that of a former Patent of February 12, 1856, (see N° 356, p. 217) states that the invention relates,—

1st. To the modes of effecting the decarbonization and refinement of iron by means of currents or jets of atmospheric air or steam (alone or mixed), made to impinge upon or pass through the metal while in a fluid state.

2nd. A mode of assisting that process of decarbonization by the use of carbonaceous matter or oxides of iron forced into the fluid metal. And,

3rd. To the manner in which the metal is formed into suitable ingots or masses.

Arrangements of blast, and cupola, and finery or running out, furnaces are described, with tuyeres placed in suitable positions for forcing in and amongst the fluid metal currents of air or steam, or both, heated, or, by preference, at their ordinary temperatures. Also a chamber or box, open at one end and closed at the other, made of brick or iron lined with loam, is used for decarbonizing the iron without the use of additional fuel. The top of the box or chamber rises at the closed end, and when it is filled full, the fluid metal rises in the higher closed parts, and is in contact with the top of the box at the other parts. Currents of air or steam are then forced in and pass through the metal to the open part, carrying thither the impurities and slag, which there escape.

A chamber is also described in which jets of air or steam act upon the surface of the metal under great pressure, as ten or twenty pounds to the square inch. When the decarbonization of iron is effected by the action of jets of air or steam passed through the fluid metal, carburetted gases, or fluid or solid carbonaceous matters may be introduced into the fluid metal in sufficient quantity to combine with any oxide that may interfere with the malleability of the iron. Apparatus suitable for this purpose is described. The metal, when the decarbonization is completed, may be left in the vessel (which is suitably shaped) to solidify; or, if vessels of other shapes be preferred, the metal is run into moulds having a runner or gate communicating with the bottom, so that the mould is filled from the bottom and rises in the mould. To prevent the metal from being cellular, the mould may be made air-tight, and the air exhausted by suitable apparatus.

[Printed, 1*s*.]

A.D. 1856, March 19.—N° 655.

STIRLING, JOHN, DAVIE, MORRIES.—"Improvements in steel "and its manufacture." The Letters Patent became void because no complete Specification was filed.

Equal parts of cast iron and wrought iron, both suitable for making steel, are taken. The cast iron is melted and poured on the wrought iron, which is reduced to small pieces; the mass is cooled by water or spontaneously. It is then broken up and melted once or oftener in crucibles with pure oxide of iron in suitable quantities. In proportion as more oxide is used the softer is the steel resulting. Oxides of zinc, tin, manganese, and other metals melted with the iron, will impart to the metal produced their well known peculiar properties.

[Printed, 3*d*.]

A.D. 1856, March 26.—N° 698.

CLAY, WILLIAM.—"Improvements in the manufacture of wrought "or bar iron." "Cast iron or fine metal" is melted and granulated by running it into water, in order to prepare it for being worked up by the usual processes. The fluid metal is allowed to fall directly into water, or from a height through perforated plates into a shaft or well, so that it is acted upon by the oxygen of the air while in a divided state; or the air may be surcharged with oxygen by allowing the hot metal to fall on a layer of salts of potass or other suitable material. Or these materials may be heated in a retort, so as to give off oxygen, which may be introduced into the shaft or well in any convenient manner.

[Printed, 4*d.*]

A.D. 1856, March 25.—N° 711.

BALL, WILLIAM.—"Improvements in machinery for stamping "ores." The ores are crushed in a mortar or vessel, supported on india rubber or other springs, by means of a stamper actuated by steam power and suitable apparatus.

[Printed, 7*d.*]

A.D. 1856, March 27.—N° 736.

BALL, WILLIAM.—"Machines for separating copper and other "metals from their ores." The pulverised ores are washed in a trough through which two currents of water are passed at different levels.

[Printed, 10*d.*]

A.D. 1856, April 4.—N° 820.

MARTIEN, JOSEPH GILBERT.—"Improvements in the manu"facture of iron." The Specification refers to that of a former Patent of September 15, 1855, (see N° 2082, p. 201,) wherein was described "a mode of purifying iron when in the liquid state after "being drawn from the blast furnace, by means of atmospheric "air or steam applied below, and so as to rise up through the "liquid metal." It proceeds to state that when the iron contains sulphur chlorine should be passed through to remove it, and if it also contains some oxide of iron, hydrogen or carburetted hydrogen may be used. Oxides of manganese or zinc, spathose ores, or clay, may in the form of powder be mixed with the iron to decarbonize and purify it.

[Printed, 3*d.*]

A.D. 1856, April 8.—N° 851.

NEWTON, WILLIAM EDWARD.—"Improvements in the process "of manufacturing steel, and carbonizing iron and the ores thereof "in the said manufacture." (*A communication.*) The iron ores are crushed or ground to the size of lumps of about 40 to the inch, they are then mixed with charcoal or other carbonaceous matters, and with, if requisite, suitable fluxes in alternate layers, and heated in a suitable cementing vessel, being maintained at a white heat for about forty-eight hours; for a large charge of about twenty tons, about six days will be required. When the process is completed the ore on cooling assumes a blue and yellow colour, then it passes to a brown, and, when overcharged with carbon, to a gray colour. When the ore is cooled it is broken or crushed and melted in crucibles to form cast steel; or it may be worked up in a furnace into spring steel. If the ores be overcharged with carbon they must be worked up in a reheating furnace, and puddled and hammered in the usual way. Both oxide and carbonate ores may be thus treated. The ore or manufactured iron when mixed with carbon is subjected to the action of heat and cyanogen, "by which "the union of carbon with the metal is accelerated and rendered "more uniform." To produce blistered steel the iron is placed in the cementing furnace with layers of carbon moistened with a solution of carbonate of potash, soda, or other alkali, and mixed with scraps or cuttings of horn or other animal matter, which will give out nitrogen by destructive distillation. The furnace being charged in layers and heat applied in the usual way, cyanogen is produced, and becomes a vehicle for imparting carbon to the iron.

[Printed, 4*d.*]

A.D. 1856, April 15.—N° 897.

SMITH, William.—"Improvements in the manufacture of steel "wire," &c. The steel wire is annealed in a furnace so constructed that the fire is separated from the steel by a wall, and acts upon it by radiated and not direct heat. The steel when heated, as it may be in six or ten minutes, is plunged into oxide of manganese, and then drawn in the usual way.

[Printed, 5*d.*]

A.D. 1856, April 16.—N° 911.

ARMITAGE, William, and LEA, Henry.—"An improvement "in the manufacture of iron." This consists in the use of blasts of air and steam combined in the smelting furnace, and also in the refinery furnace.

[Printed, 10*d.*]

A.D. 1856, April 30.—Nº 1022.

SPILSBURY, FRANCIS GIBBON.—"Separating metals, metallic "oxides, and metallic acids from their ores." The application for Letters Patent was not completed.

The ores are mixed with a concentrated solution of caustic potash or soda in water, and boiled in a boiler constructed if requisite to boil the solution under pressure. The metallic particles are left as a residuum after the boiling operation is completed.

[Printed, 3*d.*]

A.D. 1856, April 30.—Nº 1025.

MANEVY, LOUIS JEAN BAPTISTE.—"Improvements in manu"facturing cast steel." Melted cast iron is decarbonized by melting it in closed vessels with pure oxides of iron, alone or with wrought iron, lime, and potash or soda. For obtaining fine steel best white cast iron from Savoy or Isère, and best Swedish iron are used. Steel may be made from cast iron alone by working it with pulverised chalk in a reverberatory furnace, and breaking up the metal and melting it in crucibles.

[Printed, 3*d.*]

A.D. 1856, May 7.—Nº 1082.

AMORY, JONATHAN.—"Improvements in furnaces," &c. Furnaces are constructed with hollow fire bridges and passages for heating the air before it is admitted into the furnace, so as to insure perfect combustion.

[Printed, 10*d.*]

A.D. 1856, May 17.—Nº 1168.

KREEFT, SIEGERICH CHRISTOPHER.—"Improvements in the "manufacture of iron and steel." (*A communication.*) The application for Letters Patent was not proceded with.

"Steel and wrought iron of good quality" may be produced "direct from cast iron without the necessity of remelting and pud"dling the same," by casting the iron in the shape of bars or plates, and heating the latter in a suitable furnace in combination with chemical re-agents containing oxygen, until the iron is decarbonized to the required degree. Or the iron may be placed in the furnace with alternate layers of crushed quartz or fire brick, and the air be allowed to have access to the iron and decarbonize it by the action of its oxygen.

[Printed, 3*d.*]

A.D. 1856, May 19.—N° 1180.

BROWN, Jeremiah.—" Improved machinery to be used in the " manufacture of iron."

The Specification and Drawings describe rolls for squeezing and compressing puddled iron. Two or more large rolls, having parts of their peripheries cut away and parts raised with projections, are used with or without two smaller rolls; the series is made to rotate in combination, so that a bloom is drawn in by the rollers at the wide intervals, and subjected to great torsion and compression in the narrower intervals; at the same time it is "upset" laterally by the action of "rams." The Specification of Letters Patent of July 3, 1847, (see N° 11,781, p. 86) is referred to.

[Printed, 7*d.*]

A.D. 1856, May 30.—N° 1282.

WEEMS, John, and McCRINDELL, John Henderson. — " Improvements in the manufacture or working of metals and " their ores." These relate to the use of air heated by means of steam heated surfaces in the various processes of manufacturing iron. The air is heated by being passed through tubes themselves inclosed in larger tubes containing steam, which may, if requisite, be superheated.

[Printed, 7*d.*]

A.D. 1856, May 31.—N° 1292.

BESSEMER, Henry.—" Improvements in the manufacture of " iron and steel."

The Specification and Drawings describe improved apparatus for carrying into effect the system of manufacturing malleable iron and steel by forcing into the fluid molten iron currents of air, steam, or gases evolving oxygen, and also for casting ingots of the metal, which processes were the subjects of former Letters Patent granted to the patentee.

1. A cylindrical iron vessel is made of iron, lined with segmental fire bricks, or other suitable substance; above the throat of the vessel is a chamber wherein may be placed bar ends or scrap, or

other materials. In the lower part of the vessel are introduced tuyeres, and suitable openings and apparatus are provided for introducing the fluid molten iron, and for the escape of the impurities when driven off. The vessel is first heated, if requisite, and all the ashes and cinders are raked out through a suitable opening; the fluid iron is then run in, and the currents of air or steam, or gases evolving oxygen, are forced up through the fluid metal as the temperature rises, in consequence thereof the materials placed in the upper chamber are heated, and may, as required, be raked down and melted with the fluid mass in the vessel. Suitable fluxes and alloys of metals may be introduced in the form of powder through the tuyeres, or from the upper chamber, or in any other convenient way.

2. For making large ingots a solid iron mould is used, and in its bottom end is fitted a solid plunger connected to the ram of a hydraulic press, whose cylinder is firmly bolted to the mould block. Above the mould is a plate-iron vessel, which acts as a ladle. The mould is placed at the side of the refining vessel, and the metal is run out from it into the ladle, a plug is removed from its bottom and the metal runs from below into the mould, leaving the scum and impurities at the top in the ladle. The mould is cooled by the application of water, and the ingot is forced up by the plunger and ram. If necessary the ingot is subjected to great pressure to make it close and solid, by covering the mould with a flanged top, and pressing the ingot up against it prior to its removal. The cellular formation of the ingot may be further avoided by not allowing the oxygen of the atmosphere to act on the metal as it descends into the mould, and preventing the spontaneous disengagement of gaseous matter; the mould is with that view made closed, so that compressed air mixed with carbonic or other non-combustible gases may be injected above the ingot under pressure; by that means combustion arising from contact between oxygen and the fluid metal, and the disengagement of gases while forming the ingot, may be prevented. The inside of the mould is coated with oil and plumbago. When the ingot is cast and raised from the mould by the plunger, a railway track is run over the mould, the ingot is pushed up and received between two palls resting on its frame, and thus supported it is carried away on the truck, and the plunger descends; the mould is again coated with oil and plumbago, and another ingot may be cast.

[Printed, 1*s*.]

A.D. 1856, June 4.—N° 1337.

GIBON, Alexander Louis, and FRÖHLICH, André.—"Im-"provements in economising fuel in the treatment of metals."

The Specification and Drawings describe several arrangements of furnaces, wherein a common hearth is made to heat several furnaces, so that the metals as required may be transferred from one to the other, and the furnaces are worked in relation to one another without loss of heat.

Waste heat is by suitable apparatus applied to heat boilers and other purposes.

[Printed, 1*s.* 4*d.*]

A.D. 1856, June 20.—N° 1458.

JONES, Stopford Thomas, and HARRIS, Josiah.—"Separating iron from crushed mineral ores in water." The application for Letters Patent was not proceeded with.

The crushed ores are placed in a water-tight cylindrical case with water, and agitated by means of revolving fans. The iron in the ores containing it is separated by means of magnets, stationary or made to revolve.

[Printed, 3*d.*]

A.D. 1856, June 23.—N° 1474.

DYSON, George. — "Improvements in the manufacture of iron." The Letters Patent became void, because no complete Specification was filed.

The Provisional Specification states that the invention "consists "in giving rotatory motion to the bottom" of the puddling or boiling furnace, or at least to the part containing the melted metal. The tools are kept stationary, and the metal is thereby agitated and stirred "until the whole is converted into malleable "iron or puddled steel, as may be desired." The process may be carried on at one operation or divided into two or more, by dividing the furnace into corresponding chambers, "for instance "melting, refining, and puddling, or boiling and balling."

[Printed, 3*d.*]

A.D. 1856, June 24.—N° 1486.

POPE, Abraham. — "Improvements in the manufacture of "steel." The application for Letters Patent was not proceeded with.

Iron manufactured into the form of thin ribbons or hoop iron is to be converted into steel by the use of cementing troughs with openings in their ends, through which the steel ribbons may be "threaded" and drawn. The troughs are filled "with a "mixture of carburetted anhydrous silicate of alumina, or other "carburetted shale, as the refuse from boghead or Torbane coal, "after the extraction of gas therefrom, and a small quantity of "spent oxide of manganese, or other compound of manganese not "containing sulphur," or other converting materials may be used. The troughs are heated in the usual way, and as the portions of the ribbons are converted they are drawn through the troughs. The waste of material at the exit is provided for by supplying fresh material at the entrance.

To weld and forge steel it is heated in a chamber into which carbonic oxide is introduced, then welded or forged by hammers or rollers.

[Printed, *3d.*]

A.D. 1856, July 2.—N° 1549.

JOHNSON, John Henry.—"Improvements in the manufacture "of cast steel." (*A communication.*) The application for Letters Patent was not proceeded with.

Cast steel may be produced "at an extremely low price" by at once converting the iron after leaving the puddling furnace. This is done by conveying it directly to the fusing crucibles, or by previously plunging it into cold water and crushing it, and then fusing it in the crucibles. The furnaces are to be so arranged that the heat for the puddling furnace may heat the crucibles in the melting furnace.

[Printed, *3d.*]

A.D. 1856, July 7.—N° 1587.

CHENOT, Alfred L. S., and CHENOT, Eugène C. A.—"A "method of extracting eliminating extraneous substances from "steel sponges."

The complete Specification was filed with the petition. It states that the invention consists in the use of "a quantity of sand, pounded bricks, or other refractory substances," thrown into the crucibles "in order to cool the dross and bring it to a certain "degree of consistency that it may afterwards be skimmed off by "*means of* a spattle."

[Printed, 3d.]

A.D. 1856, July 7.—N° 1588.

CHENOT, Alfred L. S., and CHENOT, Eugène C. A.—"Improvements in sorting ores or separating metals, &c."

A complete Specification was filed with the petition. It describes with numerous Drawings apparatus for separating metals by means of electric agency.

[Printed, 1*s.* 1*d.*]

A.D. 1856, July 7.—N° 1589.

CHENOT, Alfred L. S., and CHENOT, Eugène C. A.—"Improvements in machinery for compressing metallic sponges, &c."

A complete Specification was filed with the petition. It describes with eight sheets of Drawings apparatus suitable for compressing and crushing ores or metallic sponges, such as are formed by pouring iron into water, &c.

[Printed, 2*s.* 7*d.*]

A.D. 1856, July 7.—N° 1590.

CHENOT, Alfred L. S., and CHENOT, Eugène C. A.—"Improvements in apparatus for the reduction of metallic oxides."

A complete Specification was filed with the petition. Retorts are described heated externally by flues, and also reducing furnaces into which flames or heated gases are introduced for reducing iron and other ores.

[Printed, 10*d.*]

A.D. 1856, July 16.—N° 1679.

GURLT, Adolphus Frederick.—"Improvements in the "manufacture of iron and steel."

The Specification and Drawings describe, first, a reducing furnace, in which the iron ores are reduced and carbonized. The furnace has a sloping shaft of brick rising above its top, and is closed at the bottom by an iron door. Two deep chambers communicate with this shaft by means of flues called "gas generators," with openings at the top for the introduction of the fuel and tuyeres below for the blast. The blast "partially burns the fuel "and produces in its passage through the fuel reducing and "inflammable gases which pass through the flues into the sha A blast of air is introduced into the flues in sufficient quantitie keep up the combustion of the gases; "by this means there pas "into the shaft a mixture of flame and carbonizing and reduci "gas by which the iron ore is heated" and carbonized. Th time during which the ores must be acted upon will depend on th product desired. If cast iron be desired, the ore must remain until it has taken up the maximum quantity of carbon; if steel be desired, the time must be shorter; and if malleable iron, a still shorter time. As the ore is drawn out at the bottom of the shaft fresh ore is filled in at the top, and so the operation is continuously kept up. The ore so prepared is melted in a "blow-pipe melting furnace." This consists of a flat hearth covered with a low arched roof, with a "gas generator" at either end, similar to those used with the reducing furnace. Each is filled about two thirds full of fuel, and blast is supplied from tuyeres. Above each gas generator is a "blow pipe" supplying a blast, "so regulated that it exactly "burns the gas produced in the generators," the effect being "that no smoke" escapes, and also that no air from the blow pipes passes away unburnt or unused. The ore from the reducing furnace being placed upon the hearth is "left there until it is "melted, if cast iron or steel be desired; if malleable iron be de- "sired, the ore being scarcely carbonized will not melt, but "becomes pasty," and is balled and hammered in the usual way. Raw ores may be mixed with the reduced ores, as found requisite to obtain the proper amount of carbon; and the furnace may be used for melting steel or iron, or as a refinery furnace.

[Printed, 1s. 1d.]

A.D. 1856, July 23.—Nº 1742.

ONIONS, John.—"Improvements in the manufacture of iron." A complete Specification was filed with the petition for Letters Patent. It states the improvements to consist in making use of the heated air, gas, smoke, and other products of combustion from boiler, furnace, or other fires, and applying them alone or with smoke, or pulverized or other fuel, at the tuyere of a blast furnac used for reducing ores. A suitable furnace is described and shewn in the Drawings.

[Printed, 6d.]

A.D. 1856, August 6.—N° 1853.

PALMER, GEORGE HOLWORTH.—"Improvements in furnaces "for generating heat." The application for Letters Patent was not completed.

Furnaces with double chambers are proposed to be employed, in which the fuel is subjected to "double decomposition." In the first chamber the green coal is carbonized, in the second it undergoes further combustion "exclusively for the generation of "carbonic oxide," which is mixed with air and the products of combustion from the first chamber, and is to be applied to the smelting of metals.

[Printed, 3*d.*]

A.D. 1856, August 19.—N° 1938.

BESSEMER, HENRY.—"Improvements in the manufacture of "iron and steel." Crude molten iron or remelted pig or refined iron may be rendered "malleable, in part by a process of puddling," and in part by forcing into and among its particles air, or materials evolving oxygen or hydrogen (which removes sulphur), without the use of any fuel or heat externally applied to either process.

A furnace is described with two chambers, in one of which the fluid iron is acted upon by the injected currents; in the other, which is heated by the former operation, the puddling process is carried on. Instead of stirring the iron with puddling tools, it may be placed in a vessel which is made to rotate or oscillate, and so agitate and puddle the iron.

A furnace is described in which the waste heat from the converting process is applied to remelting crude iron, or it may be applied to a boiler to generate steam.

A furnace is also described for melting and treating with currents of steam, air, or gases, the slag and scoria thrown off by the converting process, and obtaining iron therefrom. The melted slag and melted vitreous matters may be used for pouring over ingots that are cellular on their surfaces while the ingots are left in the heating furnaces, or when they are reheated.

[Printed, 9*d.*]

A.D. 1856, August 23.—N° 1972.

FARMER, GEORGE JAMES.—"Improvements in hardening iron "and steel." Articles after they have been cast of iron or steel

" inflammable gases which pass through the flues into the shaft." A blast of air is introduced into the flues in sufficient quantities to keep up the combustion of the gases; "by this means there passes " into the shaft a mixture of flame and carbonizing and reducing " gas by which the iron ore is heated" and carbonized. The time during which the ores must be acted upon will depend on the product desired. If cast iron be desired, the ore must remain until it has taken up the maximum quantity of carbon; if steel be desired, the time must be shorter; and if malleable iron, a still shorter time. As the ore is drawn out at the bottom of the shaft fresh ore is filled in at the top, and so the operation is continuously kept up. The ore so prepared is melted in a "blow-pipe melting furnace." This consists of a flat hearth covered with a low arched roof, with a "gas generator" at either end, similar to those used with the reducing furnace. Each is filled about two thirds full of fuel, and blast is supplied from tuyeres. Above each gas generator is a "blow pipe" supplying a blast, "so regulated that it exactly "burns the gas produced in the generators," the effect being "that no smoke" escapes, and also that no air from the blow pipes passes away unburnt or unused. The ore from the reducing furnace being placed upon the hearth is "left there until it is " melted, if cast iron or steel be desired; if malleable iron be de- " sired, the ore being scarcely carbonized will not melt, but " becomes pasty," and is balled and hammered in the usual way. Raw ores may be mixed with the reduced ores, as found requisite to obtain the proper amount of carbon; and the furnace may be used for melting steel or iron, or as a refinery furnace.

[Printed, 1*s.* 1*d.*]

A.D. 1856, July 23.—N° 1742.

ONIONS, John.—" Improvements in the manufacture of iron." A complete Specification was filed with the petition for Letters Patent. It states the improvements to consist in making use of the heated air, gas, smoke, and other products of combustion from boiler, furnace, or other fires, and applying them alone or with smoke, or pulverized or other fuel, at the tuyere of a blast furnac used for reducing ores. A suitable furnace is described and shewn in the Drawings.

[Printed, 6*d.*]

A.D. 1856, August 6.—N° 1853.

PALMER, George Holworth.—"Improvements in furnaces "for generating heat." The application for Letters Patent was not completed.

Furnaces with double chambers are proposed to be employed, in which the fuel is subjected to "double decomposition." In the first chamber the green coal is carbonized, in the second it undergoes further combustion "exclusively for the generation of "carbonic oxide," which is mixed with air and the products of combustion from the first chamber, and is to be applied to the smelting of metals.

[Printed, *3d.*]

A.D. 1856, August 19.—N° 1938.

BESSEMER, Henry.—"Improvements in the manufacture of "iron and steel." Crude molten iron or remelted pig or refined iron may be rendered "malleable, in part by a process of puddling," and in part by forcing into and among its particles air, or materials evolving oxygen or hydrogen (which removes sulphur), without the use of any fuel or heat externally applied to either process.

A furnace is described with two chambers, in one of which the fluid iron is acted upon by the injected currents; in the other, which is heated by the former operation, the puddling process is carried on. Instead of stirring the iron with puddling tools, it may be placed in a vessel which is made to rotate or oscillate, and so agitate and puddle the iron.

A furnace is described in which the waste heat from the converting process is applied to remelting crude iron, or it may be applied to a boiler to generate steam.

A furnace is also described for melting and treating with currents of steam, air, or gases, the slag and scoria thrown off by the converting process, and obtaining iron therefrom. The melted slag and melted vitreous matters may be used for pouring over ingots that are cellular on their surfaces while the ingots are left in the heating furnaces, or when they are reheated.

[Printed, *9d.*]

A.D. 1856, August 23.—N° 1972.

FARMER, George James.—"Improvements in hardening iron "and steel." Articles after they have been cast of iron or steel are hardened by subjecting them to the action of the following mixtures:—Prussiate of potash, sal ammoniac, and saltpetre are well mixed in equal proportions, and form a dry bath. Then a solution is made consisting of two ounces of prussiate of potash, four ounces of sal ammoniac, and two ounces of saltpetre to a gallon of water to form a wet bath. The cast articles are heated to a red heat and rolled in the dry bath, or sprinkled with the powder of which it is formed, then they are plunged into the wet bath and cooled, and are thereby hardened throughout unless the size of the article is too great, when they are hardened on the surface, and to a certain depth.

[Printed, 3*d.*]

A.D. 1856, August 25.—N° 1981.

BESSEMER, HENRY.—"Improvements in the manufacture of "iron and steel." "Crude or grey pig iron, hard white iron, and "steel or malleable iron," may be obtained "direct from carbonaceous iron ores, or from any mixtures of carbonaceous ores with "oxides or other ores of iron, by the application thereto of a "blast of hot or cold air or steam, or of any other gaseous matter "containing or capable of evolving oxygen or hydrogen gas, and "without requiring any fuel except such as is contained in or "is evolved from the said ores of iron, and from the gaseous "matters forced into and among the pieces of ore, and into and "among the particles of fluid metal which have been separated "from the ore."

The operation is carried on in the ordinary blast furnace, one of small dimensions being preferred. The hearth or crucible is filled with coke and thoroughly ignited with the blast; the charge of carbonaceous ores with "lime or other fluxes not mixed as in the "ordinary process with coke, coal, or other fuel," is then put in the furnace, and the blast turned on and driven up through the materials. The intense heat produced will melt the materials in the charge, "accompanied with a further evolution of heat, and "thus the process may be kept up, the charging on of materials "going on as the charge diminishes from below, so that a continuous "fusion of the ore may be kept up without the use of any fuel "other than is contained in the ore and in the air or other gaseous "matter forced therein."

The fluid cinder, rich in oxide of iron, which is produced, may *be treated* with currents of air, steam, or gases to produce metallic iron, as described in the Specification of Letters Patent of August 19, 1856. (See N° 1938, p. 231.)

Instead of a blast furnace being used, a reverberatory furnace may be employed for carrying on the operation above described, and the fluid iron produced may be run into moulds or "into a "separate vessel, and be there converted into steel or malleable "iron," as described in the Specification of Letters Patent of February 12, 1856. (See N° 356. p. 217.)

[Printed, 4*d*.]

A.D. 1856, September 1.—N° 2031.

MONCKTON, EDWARD HENRY CRADOCK.—"Improvements "in blast furnaces for smelting ores." The application for Letters Patent was not proceeded with.

In order to introduce air and gases into the furnace in great quantities under pressure, the sides of the furnace are to be "fitted or surrounded with a series of air or gas tubes or chan-"nels, for the purpose of causing the blast to converge from all "sides upwards and downwards" from "extended or enlarged "orifices."

[Printed, 3*d*.]

A.D. 1856, September 1.—N° 2032.

LEVICK, FREDERICK.—"Improvements in the construction "and working of blast furnaces for the smelting or making of "iron." The application for Letters Patent was not proceeded with.

The furnaces are to be made with large interiors, and the hearths to have a double set of tuyeres set round them radially in two tiers. The blast is to be used at a greater pressure than ordinary, and, if required, at different pressures for the two sets of tuyeres arranged on different levels, or they may be on the same level.

[Printed, 3*d*.]

A.D. 1856, September 3.—N° 2039.

THOMAS, GEORGE CUMMING.—An improved method of mak-"ing steel." (*A communication.*) "A composition of chloride of "sodium, prussiate of potash, and bichromate of potash," is added to the iron when in a molten state, or at a lower heat in the various stages previously to its being cast into form, or to its being converted into steel. With 40 lbs. of metal, 1 lb. of a flux composed of 16 parts by weight of chloride of sodium, 3 parts of prussiate of potash, 1 of bichromate of potash, and 4 of pulverized animal charcoal may be used. Other proportions may also be used as specified.

[Printed, 3*d*.]

A.D. 1856, September 14.—N° 2061.

TABBERNER, JOHN LOUDE.—"Improvements in smelting "ores." The smelting furnaces are made in a conical or pyramidical form, with tuyeres so arranged as to inject the blast both into the belly and into the hearth of the furnace.

Instead of a large furnace several small furnaces are employed, which discharge their contents "into one large reservoir, from "which the molten metal may be drawn for casting."

[Printed, 3*d*.]

A.D. 1856, September 8.—N° 2090.

DALTON, ALFRED.—"Improvements in smelting iron stones "and ores in furnaces used for that purpose." The application for Letters Patent was not proceeded with.

Atmospheric air or steam is to be admitted under pressure into the hearth of furnaces, near the bottom, and beneath the surface of the melted metal. Also metallic iron is to be used as a flux.

[Printed, 3*d*.]

A.D. 1856, September 10.—N° 2108.

ROBERT, ALEXANDRE.—"A new process of treating, &c. refrac-"tory metallic ores." The application for Letters Patent was not proceeded with.

The ores are to be pulverized and mixed with marl clay diluted with water. In this plastic state they are to be smelted in a furnace with coke.

[Printed, 3*d*.]

A.D. 1856, September 10.—N° 2112.

GILBEE, HENRY.—"Improvements in the manufacture of iron." (*A communication.*) The application for Letters Patent was not *proceeded* with.

The melted iron as it flows from the furnace is conducted in a suitable trench, and a strong current of atmospheric air at several places is forced perpendicularly or obliquely through the metal.

The stream of metal may be arrested by bridges or stops, so as to separate the scoria and leave the pure iron exposed to the influence of the currents of air.

[Printed, 8*d.*]

A.D. 1856, September 15.—N° 2155.

CLEMENTS, Cornelius Ferguson.—" An improvement in " separating copper and other metals from ores containing them." The ores specially referred to are those of copper. Muriatic acid vapours produced from furnaces used in making sulphate of soda are made to act on the ores, and aid in reducing them.

[Printed, 3*d.*]

A.D. 1856, September 16.—N° 2168.

MUSHET, Robert.—" Improvements in the manufacture of " iron." " When cast iron, including grey and white pig iron and " refined metal, has been decarbonized or purified by forcing air " through or among its particles, either in the manner described " in the Specification of Letters Patent, dated September 15, 1855, " granted to Joseph Gilbert Martien, (see N° 2082, p. 201,) or in " any convenient manner, with a view to convert it into malleable " iron," the ingots or masses formed by iron so treated when cast into moulds, is often found cellular or porous or crystalline. To remedy this defect and make the iron more malleable, and solidify the ingots and bars and improve their quality, there is added to the iron, partly at one stage and partly at another, during the decarbonizing process, a mixture of about equal weights of black oxide of manganese and pitch, coal tar, resin, charcoal, and other carbonaceous matter. The mixture should be melted to form a compact mass, then cooled and pulverized. At the commencement of the purifying process the mixture, in proportions of from one fiftieth to one tenth by weight of the fluid iron, is placed in the purifying vessel or furnace, the fluid metal is then run in and treated with currents of air, or the mixture may be introduced through suitable openings after the slag and scoria have been thrown off by " the eruption," or it may be added when the purifying process is completed. The iron, after the mixture is added, is left as long as possible without solidification ensuing in the purifying vessel or furnace, it is then run off into ingots and rolled or hammered. To improve still further the quality of the iron, it may be run into pots or crucibles, like ordinary cast-steel melting pots; these are brought previously to an intense white heat; one twentieth by weight of the mixture of oxide of manganese and carbonaceous matter is added then to the metal, and the pots are placed in the furnace and treated in the manner usually practised by steel manufacturers.

[Printed, *4d.*]

A.D. 1856, September 16.—N° 2169.

MUSHET, Robert.—" Improvements in the smelting of iron " ores." The Letters Patent became void, as no complete Specification was filed.

The Provisional Specification states that the invention consists in " the application of combustible carbonaceous matters, together " with air or blast." The carbonaceous matters, as powdered coal, coke, charcoal, &c., are to be introduced through tuyeres with the blast.

[Printed, *3d.*]

A.D. 1856, September 16.—N° 2170.

MUSHET, Robert.—" Improvements in the manufacture of " iron." " When air or blast is used in the deoxydizing or puri" fying of iron in the manner described by the Specification of a " Patent granted to Joseph Gilbert Martien, dated September 15, " 1855, (see N° 2082, p. 201,) it has a tendency to oxydize the " iron," and so cause waste. The improvements consist " in the " introduction of carbonaceous fuel or matter into the furnace or " vessel containing the molten iron to be decarbonized or puri" fied." The carbonaceous fuel or matter is reduced to fine powder, and may be placed in a suitable receptacle, as a cylinder, with a screwed plug or piston communicating with the tuyeres, and is so conveyed with the blast " into and amongst the melted " iron in the purifying vessel or furnace." Or the matters may be placed upon the surface of the metal or introduced in the vessel before the metal is run in. From five to ten pounds of powdered fuel (as free as possible from sulphur) may be used with 100 pounds of molten iron, and will prevent excessive waste of the iron and make it more tough and malleable.

[Printed, 4*d.*]

A.D. 1856, September 16.—N° 2171.

MARTIEN, Joseph Gilbert.—"Improvements in the manu-"facture of iron."

The Specification states that "the subjecting fluid iron as it "flows from a smelting furnace to the influence of gas or gases," separately or combined, heated or not, also to that of any alkaline, earthy, mineral, or metallic substance," separately or combined, was set forth in a former Patent, dated April 4, 1856 (see N° 820, p. 222); also that the present invention "consists in applying "to and disseminating through and amongst fluid iron, or fluid "metal possessing the characteristics of iron, of any kind, form, or "description whatsoever, as it flows from or whilst in a transition "state from a melting or remelting furnace" or fire, or any vessel or place of any kind or form "from which fluid iron may or can "flow (except from a smelting furnace), atmospheric air" or oxygen, chlorine, hydrogen, or carburetted hydrogen gases, separately or combined, heated or not, for heating, or oxydizing, or deoxidizing, carbonizing, or decarbonizing, or purifying the metal. It is also stated to consist in the use, under similar circumstances, of nickel, zinc, or manganese, or carbonaceous matter, or kaolin, "or any saline, alkaline, vegetable, earthy, mineral, or metallic "matters, separately or combined, in any form, state, or condition," for acting upon iron.

[Printed, 3*d.*]

A.D. 1856, September 18.—N° 2183.

BAGGS, Isham.—"Improvements in smelting and reducing "copper and other metals from their ores," &c. The application for Letters Patent was not completed.

The ores, as those of copper or iron, whether calcined or not, are to be mixed with "siliceous or other proper materials as a flux "or fluxes" and fused. The result from iron ores is that a silicate of iron is formed, which is skimmed off. The residuum is subjected to the action of currents of air or gases, heated or cold forced through tuyeres.

[Printed, 3*d.*]

A.D. 1856, September 18.—N° 2184.

HINDE, THOMAS CALLENDER.—" Improvements in the manu-" facture of iron." The iron ore is calcined and broken up, and then placed in a furnace with charcoal in alternate layers, and heated for about two days, when the oxygen in the oxides of iron is withdrawn, and the iron is in a spongy state, and is malleable. The process may be carried further until the iron absorbs more carbon, and becomes in character steely, or like grey forge iron. It may be then melted in a small furnace (like an air furnace), and in a shorter time than is now required in ordinary smelting furnaces. Contact between the fuel and the iron should be prevented by using a reverberatory furnace, or one constructed like a brick kiln with flues.

Another kind of furnace is also described for carrying on the process.

[Printed, 4*d.*]

A.D. 1856, September 20.—N° 2211.

COCHRANE, The Honourable WILLIAM ERSKINE.—" An " apparatus for converting crude iron while in a fluid state " into malleable iron or steel. The application for Letters Patent was not completed.

The fluid crude iron is to be converted into malleable iron and steel "by a process the reverse of that which has hitherto been adopted, namely, allowing it to flow down " inclined planes exposed to a forced current of atmospheric or other air, "instead " of forcing air into or upon quiescent fluid metal, as heretofore " practised or proposed."

[Printed, 3*d.*]

A.D. 1856, Sepember 22.—N° 2218.

TAYLOR, WILLIAM.—" Improvements in the conversion of cast " iron into steel and malleable iron." Molten cast iron is to be treated with streams of hydrogen gas or subcarburetted hydrogen gas (made from oils or resins so as not to contain sulphur) forced into and amongst its particles from tuyeres, directed into a suitable vessel beneath the surface of the fluid metal.

[Printed, 5d.]

A.D. 1856, September 22.—N° 2219.

MUSHET, Robert.—" Improvements in the manufacture of " iron and steel." When iron is purified and decarbonized by being heated with currents of air, it is often found defective from having flaws and being "red short" or "cold short." To remedy these defects "a triple compound," consisting of iron, manganese, and carbon, is mixed with the iron while in a fluid state, in proportions of about from two to three per cent. for malleable iron, three to five per cent for semi-steel, and five to twenty per cent. for hard steel. The proportions of these ingredients may be varied according to the quality of the metal required to be produced, whether malleable iron or steel. The triple compound may be formed by smelting cast iron with coal or charcoal and iron ores containing much manganese, as the Prussian "spiegel eisen." It should by preference be fused and rendered fluid before being mixed with the fluid iron.

[Printed, 4*d.*]

A.D. 1856, September 22.—N° 2220.

MUSHET, Robert.—"Improvements in the manufacture of "iron and steel." Iron purified or decarbonized by being heated with currents of air, according to the "Specification of Joseph Gilbert Martien, of September 15, 1855, (see N° 2082, p. 201,)" or in any other way, is often defective from having flaws or being "red short" or "cold short." These defects are remedied by using about two pounds of metallic manganese to 100 pounds of molten iron. The manganese is to be pulverized and mixed with the fluid iron, or placed in the mould or ladle into which it is run.

To obtain steel, the decarbonizing process is arrested when the proper per-centage of the carbon is left unconsumed, and metallic manganese is then added. Or pure cast iron may be added to the purified or decarbonized iron in sufficient proportions with metallic manganese.

[Printed, 4*d.*]

A.D. 1856, October 6.—N° 2334.

MACKWORTH, Herbert.—" Improvements in separation and " treatment of mineral substances, and in coking, and in apparatus " connected therewith." The Specification and Drawings describe crushing apparatus for separating nodules of ironstone from shale; also apparatus for washing, sifting, and sorting ores; also coking ovens, wherein currents of air or gas are drawn upwards through the coke by means of a chimney or other exhausting power.

[Printed, 1*s.* 9*d.*]

A.D. 1856, October 6.—N° 2336.

AVRIL, VICTOR.—"Improvements in the manufacture of iron "and steel." The application for Letters Patent was not proceeded with.

Crude iron is to be refined and converted into malleable iron or steel, by treating it, while in a heated or, by preference, in a liquid state, with chlorate or nitrate of potassa.

[Printed, 3*d.*]

A.D. 1856, October 6.—N° 2237.

AVRIL, VICTOR.—"Improvements in the manufacture of iron "and steel, and in the construction of furnaces, &c." The application for Letters Patent was not proceeded with.

Crude iron is to be converted into steel or malleable iron "by "means of currents or blasts of oxygen in a pure and electrified "state, or state of ozone, or in the incipient or the most oxydating "or condensed condition, instead of atmospheric air." The process is to be conducted in low furnaces specially adapted to it. The oxygen may be obtained by collecting the carbonic acid gas that escapes at the mouth of the furnace, and treating it with potassium or by other processes as described.

[Printed, 3*d.*]

A.D. 1856, October 9.—N° 2369.

HOWELL, JOSEPH BENNET.—"Improvements in the manu-"facture of cast steel." The invention consists in the use of the "scale which falls off steel or iron during the process of hammer-"ing or rolling in addition to the ingredients in common use for "making cast steel." The object of the invention "is to make a "superior quality of cast steel, or a homogeneous metal, from the "*commoner* kinds of iron."

[*Printed, 3d.*]

A.D. 1856, October 20.—N° 2451.

KNOWLES, Sir Francis Charles.—" Improvements in the " manufacture of iron and steel, and in the preparation of fuel " used therein." Fuel is coked in suitable kilns provided with flues, so that waste gases from the blast furnace may be passed through the fuel in a heated state. A furnace is also described having pipes proceeding from the top to the bottom of the furnace, by which currents of air are introduced near the bottom of the melted metal, and are driven up through and among its particles. Hydrogen or carburetted hydrogen gases are passed through the molten iron to purify it from sulphur and phosphorus.

[Printed, *6d.*]

A.D. 1856, October 20.— N° 2463.

CLAY, William, and HARRIS, Josiah.—" Improvements in " the manufacture of iron and steel." Currents of air or gases are made to pass over or through molten iron, to purify and convert it into a more malleable state, by means of an exhaust apparatus. To enable the workman to watch the progress of the operation, the furnace is so made that a portion of the molten metal contained in the hearth is presented to view outside, and is exposed to the atmosphere. " Dipping into this hearth is a por- " tion of the furnace wall, which, when a charge of molten metal " is run into the hearth, will form with the metal an air-tight " joint, after the plan of what is known as a hydraulic joint. " The furnace may, when desired, have a second hearth at a higher " level, to receive the pig iron which is to be melted and operated " upon ;" this may be heated by the waste heat from the lower hearth. The molten metal is run into the annular or other shaped part outside the furnace, communicating with the open air and also with the interior, and is allowed to find its level in the interior ; or it may be run into the interior through suitable openings. The air or gases are exhausted from the interior of the furnace by a fan or other suitable means, and " when a sufficient vacuum has " been produced," air will pass down through the molten metal outside and up through the metal inside the furnace. The operation is carried on until the metal has been sufficiently acted upon by the currents.

[Printed, *10d.*]

A.D. 1856, October 28.—N° 2532.

CHEETHAM, JAMES KINDER.—"Improvements in the manu- " facture of iron and steel." The application for Letters Patent was not completed.

The invention consists in " oxidizing iron, by admitting aqueous " vapour or other source of oxygen thereto when in a heated state, " but under the fusing point." It is then to be fused. The iron may be previously granulated, or otherwise divided into small portions.

[Printed, 3*d.*]

A.D. 1856, October 29.—N° 2537.

WYCHE, THOMAS EYRE.—" A method of disengaging metals " from the matrix." (*Partly a communication.*) The application for Letters Patent was not proceeded with.

The ores are to be broken small and then put into a steam-tight boiler with water mixed with caustic alkali, and boiled.

[Printed, 3*d.*]

A.D. 1856, November 10.—N° 2639.

BESSEMER, HENRY.—" Improvements in the manufacture and " treatment of iron, and in the manufacture of steel." The Specification and Drawings describe apparatus for agitating molten fluid iron in closed vessels of a suitable shape, the vessels being connected directly to the piston of a steam engine or moved by a crank motion. Molten crude iron, melted pig or partially refined iron, or iron treated by the process described in the Specification of Letters Patent granted to the patentee, and dated February 12, 1856, (see N° 356, p. 217,) is placed in the agitating vessel with slags, scoria, or suitable fluxes and purifying agents, and the iron being brought into a state of mechanical combination therewith by the reciprocating or other motion is thoroughly mixed with and exposed in a divided state to the action of the slags or other agents. Currents of air or steam or gases may at the same time be introduced through pipes moving in stuffing boxes into the agitating vessel, and be so made to act upon the divided particles of the fluid iron. In order to cause the fluid iron to run from the vessel in a very divided form, or in a granulated state when that is thought advisable, streams of air or steam are made to impinge upon the stream of fluid metal as it issues from the tapping hole, and so scatter and divide it. Or the metal is allowed to fall upon slags or other substances in a shower of small particles.

[Printed, 1*s*.]

A.D. 1856, November 14.—N° 2695.

BINKS, CHRISTOPHER.—" Improvements in converting iron " into steel, and in giving a coating of steel to iron." Iron is converted into steel by the agency of " cyanogen or ammoniacal com- " pounds, or a mixture of their elementary constituents " which are brought " in contact with the surface or progressing developed " surfaces " of the iron to be converted. They may be sprinkled in the form of powder on masses of the heated iron while being rolled or hammered, or be brought into contact with iron in sheets by means of a bath, or by any other convenient method. The compounds preferred are cyanides or ferrocyanides of sodium, or calcium, or potassium, or iron, or manganese; by preference, those that fuse at a red heat are to be used. Articles of iron which are shaped in a heated state by being passed through rollers, or by being hammered, have a coating of steel imparted to them by sprinkling them with the powdered cyanogen compounds, and dipping them in a solution thereof. These compounds, especially ferrocyanide of sodium, with an alkaline carbonate, as soda, may be advantageously used in the cementing process. Atmospheric air, alone or with ammonia, may be allowed to enter into the cementing vessels through suitable small openings and permeate through the heated mass.

[Printed, 4*d*.]

A.D. 1856, November 14.—N° 2699.

AITKEN, JOHN.—" Improvements in furnaces employed in the " manufacture of iron and other metals." The application for Letters Patent was not completed.

The furnaces are to be provided with suitable apparatus for drawing off on the exhaust principle the air and gases from above the melted iron. Currents of air may be made to pass into and up through the metal, which is caused to boil, and is so rendered fibrous and malleable.

[Printed, 3*d*.]

A.D. 1856, November 15.—N° 2702.

HOARE, Deane John.—"Improvements in the manufacture of "iron." The application for Letters Patent was not completed.

"The iron having been converted into a molten or fluid state "by Bessemer's process, or by any other, for the purpose of "purifying or decarbonizing it," is to be poured down an inclined channel, which may be heated from below. The molten iron as it rolls along is interrupted by suitable stops; it is exposed thereby to the action of the air, and undergoes a "self-puddling process," and is afterwards to be worked up into malleable iron or steel.

[Printed, 3*d.*]

A.D. 1856, November 15.—N° 2703.

MUSHET, Robert.—"Improvements in the manufacture of "iron."

These relate to a mode of granulating iron or reducing it to powder. Iron heated to a temperature a little below the melting point, becomes softened, and its particles possess little coherence. When in that state it is stamped or crushed to powder or pulverized in large mortars, and may be afterwards converted into steel or malleable iron.

[Printed, 3*d.*]

A.D. 1856, November 15.—N° 2704.

BARCLAY, Andrew.—"Improvements in the manufacture of "iron." A compound furnace is described for reducing ores and producing cast or wrought iron directly therefrom. The furnace has "a fireplace or fuel chamber of the ordinary kind, a molten 'metal or puddling recess" behind the fire bridge, and at the back an inclined shelf on which the ore is placed when introduced through an opening at the back of the furnace. The ores are first roasted or calcined, and made to contain a large amount of carbon; they are melted by the reverberated heat, and the iron as it trickles down from the shelf into the puddling recess may be refined by currents of air, and may then be puddled or run out into moulds. Pig iron may be so treated instead of using the ores; and suitable *fluxes* are employed in the process.

[Printed, 7d.]

A.D. 1856, November 15.—N° 2711.

BINKS, Christopher.—"Improvements in the manufacture of "iron and steel." The iron is melted in a blast or other furnace, and run into a purifying furnace described. It is then treated with purifying compounds of cyanogen, and currents of gaseous matters, as atmospheric air passed through red hot carbonaceous materials, coke or charcoal, are forced through the molten metal. It may then be puddled in the ordinary way, or the carbon may be removed by treating the metal with oxygenizing currents. Or currents of nitrogen and carbonic oxide and ammonia, or ammonia alone, may be passed through the decarbonized iron with cyanogen compounds for converting it into steel.

[Printed, 5*d.*]

A.D. 1856, November 18.—N° 2726.

BESSEMER, Henry.—"Improvements in the manufacture of "iron." The invention relates to puddling furnaces for "facilitating the process of puddling," and employing the spare heat of the puddling furnace in remelting and refining other portions of iron, and for reducing slags or oxides of iron, and obtaining therefrom metallic iron. A reverberatory furnace is constructed with three compartments, the centre one, No. 2, being on a higher level than No. 1 in front, and No. 1 higher than No. 3, which is at the back of the furnace. In the front is the fireplace; in No. 2 is placed pig iron or refined iron, which is there melted; it is then run into No. 1, where it is puddled, and meanwhile a new charge of iron is put into No. 2, where also iron may be refined by being blown by tuyeres situated below the level of the metal. The slag formed in No. 1 and No. 2 during the puddling and refining processes is conveyed to No. 3, and being well mixed with coal, or bituminous or carbonaceous matters or fluxes, gives off metallic iron, which may be puddled and refined in the usual way. The refining process may be carried on in a separate furnace.

[Printed, 6*d.*]

A.D. 1856, December 2.—N° 2861.

SIEMENS, Frederick.—"Improved arrangement of furnaces, "which improvements are applicable in all cases where great heat "is required." Furnaces for smelting, heating, &c. iron or other metals are so constructed that the outgoing products of combustion are made to impinge upon and impart all their heat, or nearly so, to an extended surface of brickwork or other refractory material interposed between the place of combustion and the exit stack or chimney. Currents of cold air or gases on their way to the place of combustion are, by means of a suitably constructed valve, made to impinge first upon the less and then upon the more intensely heated surfaces, and so recovering the heat deposited by the outgoing currents, proceed, heated nearly to the temperature of the fire itself, to the place of combustion, where they are made effective by melting materials placed there.

The Specifications and Drawings, which should be referred to, describe a furnace, having one heating chamber placed between two fireplaces separated therefrom by fire bridges. An open passage leads from each fireplace to a chamber called a regenerator. divided by open walls of brickwork, the bricks in the second wall being opposite to openings in the first wall "built in what is "called open Flemish bond." In the chimney is a valve, by means of which the communication between either regenerator and the chimney may be opened or closed. When fuel is lighted in one of the fireplaces, as No. 1, the heated products of combustion pass over the bridge into the heating chamber, act upon the metals therein, and then pass on through the fireplace No. 2, on the other side thereof, and thence through the many openings of the brick walls in the regenerator chamber, until they reach the chimney, after having parted with their heat as they impinged on the brick surfaces, those nearer to the fireplaces absorbing the greater heat. By means of the valve in the chimney the direction of the currents may be then reversed, and cold air or gases being admitted, may be made to pass through the regenerator attached to fireplace No. 2, heated as just described. The cold currents impinging first on the less heated brick surfaces near the chimney, pass on to the more intensely heated surfaces, taking up the heat there deposited, pass in a highly heated state to fireplace No. 2, wherein fuel may now be placed, and with the products of its combustion the heated currents pass over the fire bridge into the heating chamber, and act upon the metals therein deposited, which process absorbs a certain amount of heat. The surplus heated products of combustion pass on through the fireplace No. 1, to the regenerator chamber connected therewith, and so the heated outgoing currents deposit their heat as they impinge upon the brick surfaces on their way to the chimney; and when the operation is reversed by the action of the valve in the chimney, the heat is again reconducted to and made available in the heating chamber, by which means "an almost unlimited heat is effected."

Other arrangements of furnace may be used on this principle. One is described in which carburetted hydrogen or other inflammable gas may be used instead of fuel. One or more pairs of regenerator chambers may be connected with one fireplace, and the incoming currents may be passed through them alternately as they are heated, or zigzag or tortuous passages divided by partitions may be used alternately for the outgoing heated and incoming cold currents. Fireplaces may be made to consume their own smoke by connecting them with regenerators, constructed as described.

[Printed, 1*s.* 5*d.*]

A.D. 1856, December 3.—N° 2870.

DEELEY, JOSEPH.—"Improvements in furnaces for smelting and " melting." The furnaces have separate compartments, in one of which the metal is melted, and in the other the fuel is burned, instead of mixing both in the same compartment. The air enters through grate bars fixed in the brickwork on each side of the furnace, passing through an opening in the brickwork to the fuel. Each chamber is diminished at the top to concentrate the heat, and is made deep in shape. The metal, when tapped, runs into a receptacle common to all the compartments.

[Printed, 9*d.*]

A.D. 1856, December 4.—N° 2880.

HOLLAND, JOHN SIMON.—" Improvements in the manufacture " of iron," &c. The application for Letters Patent was not proceeded with.

Iron is to be rendered fibrous by running it into a circular or elliptical cupola, and forcing into it in a tangential direction currents of air or steam, so as to drive the iron round and give it "rotary " motion."

[Printed, 3*d.*]

A.D. 1856, December 29.—N° 3087.

VAUGHN, HORACE. — "An improved method of hardening " and tempering steel, and of hardening cast and wrought iron."

The steel is placed in a box containing a composition formed by mixing together two pounds of bichromate of potash, twelve pounds of chloride of sodium, and four pounds of prussiate of potash, or less prussiate of potash, and instead thereof animal charcoal. The ingredients are pulverized, and the steel is immersed in them in the box, and exposed to the action of heat. The steel is then dipped in oil, or other suitable solutions. Iron is hardened by putting it in a vessel with twenty-five per cent. of prussiate of potash, sixty-five per cent. of chloride of sodium, and ten per cent. of bichromate of potash with animal charcoal, and heating it in the usual way. It is better to cover the metal and mixtures with a layer of wood charcoal.

[Printed, *4d.*]

A.D. 1857.

A.D. 1857, January 2.—N° 17.

WILSON, John.—" Improvements in the manufacture of steel." The application for Letters Patent was not completed.

Granulated cast iron is to be roasted and calcined, and then melted to obtain cast steel. Rich iron ores may be substituted for bar iron in the process of cementation to obtain steel, and the product is to be melted with from six to eight per cent. of oxide of manganese to obtain cast steel.

[Printed, *3d.*]

A.D. 1857, January 3.—N° 33.

BINKS, Christopher.—" Improvements in treating ore in the " manufacture of iron," &c. Alkaline matters, as carbonate of soda or potash, are used in the blast furnace in proportions of from two to ten per cent. of the fuel, so as to produce cyanogen compounds, and reduce the ores and purify the metal.

[Printed, *4d.*]

A.D. 1857, January 5.—N° 39.

BRAITHWAITE, Frederick.—" An improved mode of ex" tracting the iron from tin ores." The application for Letters Patent was not completed.

The ores are to be stamped and washed, and the particles of iron separated by means of magnets.

[Printed, *3d.*]

A.D. 1857, January 14.—N° 116.

HADDAN, John Coope.—" Improvements in smelting ores," &c. A smelting furnace is described having openings at various points by means of which the state of the ores may be from time to time ascertained, and gases or other reducing materials supplied, if required. The air and gases are drawn off at the top of the furnace by an exhaust fan. The waste heat is used for the purpose of calcining or roasting the ores.

[Printed, 6d.]

A.D. 1857, January 24.—Nº 221.

BESSEMER, Henry.—"Improvements in the manufacture of "iron and steel." Sheets, plates, bars, and other forms are manufactured directly from fluid iron or steel, instead of allowing the metal first to cool and set in moulds. The molten metal is run from a ladle or crucible between two suitably shaped rollers revolving at the requisite speed, and is made to set and take the required shape in a solid form while in the act of passing through them. The rolls are cooled by jets of water, and blocks or brushes are used to remove all watery particles before coming into contact with the molten metal. The surfaces of the rolls are allowed to rust, or are smeared with grease or blacklead to prevent the metal from adhering. The sheets or bars so formed may be subsequently rolled, hammered, or worked up in the ordinary way.

[Printed, 7*d.*]

A.D. 1857, January 30.—Nº 274.

LENZ, Charles.—"An improvement in the manufacture of "cast steel." The application for Letters Patent was not proceeded with.

Granulated or pulverized cast iron is to be converted into steel by melting it with suitable oxides, not in crucibles, but in a reverberatory furnace. A vitreous layer is used to protect the surface of the metal.

[Printed, 3*d.*]

A.D. 1857, February 7.—Nº 359.

BROWN, Thomas, and PARRY, George.—"Improvements "in the manufacture of iron." The Letters Patent became void because no complete Specification was filed.

Melted cast iron is to be decarbonized and refined in a suitable close vessel, by means of currents of air, hot or cold, "blown "down with considerable force upon the top of the melted metal, "so as to produce a combustion of the carbon combined or mixed "with the iron," without the addition of coal, coke, or other fuel.

[*Printed, 3d.*]

A.D. 1857, February 9.—N° 370.

TALABOT, Leon.—" Improvements in the manufacture of iron " and steel." These relate to modes of treating fluid iron with currents of air or gas or vapour. A moveable pipe with a perforated head or rose, and a mercury air-tight joint, is used, and the crucible is in the shape of an inverted cone lined with chalk or oxide of iron, or a mixture of both.

A series of puddling furnaces is described, in which charges of iron may be successively treated. Air, steam, or gases may be used separately and alternately, as found beneficial. The iron may be allowed to solidify in the crucibles.

[Printed, 4*d.*]

A.D. 1857, February 9.—N° 373.

HARDING, John.—" Improvements in the treatment of metallic " ores." Ironstone and other metallic ores are subjected to the action of steam of suitable pressure, or of steam and water in a receptacle such as is described. The application of heat and moisture has the effect of causing the shale or other extraneous matter to be readily separated from the ore.

[Printed, 9*d.*]

A.D. 1857, February 11.—N° 398.

PITMAN, John Talbot.—" An improved system of working metallic ores," &c. (*A communication.*) Two furnaces called the " alpha and omega " furnaces are described, in which iron ores are smelted and iron manufactured, and the waste products turned to account by the various apparatus and processes, as described with the aid of Drawings.

[Printed, 1*s.* 8*d.*]

A.D. 1857, February 20.—N° 493.

OAKES, William. — " Improvements in the manufacture of " iron." An apparatus consisting of doors and valves is connected with the top of the blast furnace so as to enable a regular supply of charge to be fed in. The waste gases are removed by means of a vertical central shaft or flue, and are applied to heating purposes.

[Printed, 6*d.*]

A.D. 1856, February 21.—N° 509.

THOMSON, Francis Hay.—" Improvements in the manufac" ture of iron." Carbonaceous gases are to be introduced into the blast and other furnaces used in the manufacture of iron, through suitably arranged double tuyeres, as described.

[Printed, *6d.*]

A.D. 1857, March 2.—N° 604.

JONES, Edwin Francis.—" Improvements in the manufacture " of pig and bar iron." The hot-air blast employed is heated " between two pipes one placed inside the other" in thin strata. The heat and flames from the heating furnace play round the outer pipe, then pass through the interior of the inner pipe to the chimney.

[Printed, *9d.*]

A.D. 1857, March 2.—N° 608.

PAUVERT, Charles. — " Improvements in manufacturing " iron." " Sulphur, phosphorus, and other metalloids" are driven off from puddled iron by cementation. The cement is composed of the following substances:—Oxide of iron, 14 parts by weight, highly aluminous clay 30, carbonate of lime or wood ashes 50, pulverised charcoal 4, carbonate of potassa 1, carbonate of soda 1, parts by weight.

[Printed, *3d.*]

A.D. 1857, March 2.—N° 609.

PAUVERT, Charles.—" Improvements in manufacturing cast " steel." Cast iron is decarbonised by the use of oxide of iron prepared by crushing cast iron when heated to a red heat, and wetting it with pure acidulated or alkalised water. To obtain cast steel there are placed in the melting pot 33 to 40 parts by weight of the prepared oxide of iron or iron filings, 100 parts of crushed cast iron, with from 8 to 10 parts of the composition made up of the following ingredients: — Dry carbonate of soda, by weight, 4 parts; dry carbonate of potash 4 or caustic potass 2, wood ashes 3, borax 2, oxide of manganese 3, hydrogenated carbon, soot, or lamp black 4 to 7, parts by weight. These ingredients are to be carefully mixed, and kept protected from the air.

[Printed, 3*d*.]

A.D. 1857, March 2.—N° 610.

PAUVERT, Charles.—" Improvements in manufacturing steel " and cast steel." Iron is purified and carbonised by cementation with a composition of the following ingredients:—Of pulverised charcoal, by weight, 33 parts; highly aluminous clay, 33 parts; wood ashes or carbonate of lime, 33 parts; carbonate of soda, 1 part; carbonate of potash, 1 part. A steel equal to " German " or Rives or sheer steel " is produced. It may be made into cast steel by melting in pots with a mixture consisting of dry carbonate of soda, by weight, 4 parts; dry carbonate of potash, 4 parts, or caustic potash, 2 parts; wood ashes, 3 parts; borax, 2 parts; oxide of manganese, 3 parts; hydrogenated charcoal, soot, lamp-black, 4 to 7 parts.

[Printed, 4*d*.]

A.D. 1857, March 3.—N° 627.

TAYLOR, William.—" Improvements in the manufacture of " iron and steel." Iron in a molten fluid state is placed in a suitably constructed vessel, which is made to revolve at a high velocity, so as to spread the iron in a thin stratum on the interior surface of the vessel. Compressed air is introduced into the vessel, and being made to act upon the extended surface of iron, so purifies and refines it.

[Printed, 7*d*.]

A.D. 1857, March 5.—N° 639.

DYSON, George Walter.—" Tilting iron and steel," &c. A vertical hammer is employed. It is actuated " by means of re- " volving circular incline arms, as described." The momentum of the falling hammer is increased by " applying steam with a loose " piston acting as a spring."

[Printed, 6*d*.]

A.D. 1857, March 11.—Nº 709.

HALE, William.—" An improvement in rolling iron and steel." The application for this patent was not proceeded with.

Iron or steel, while being rolled, is to be "twisted in its grain" by employing a pair of grooved rollers, which, " in addition to their " rotation on their own axes," are made " also to revolve about " the axis of the iron or steel " while it is being passed through the rolls.

[Printed, 3*d.*]

A.D. 1857, March 17.—Nº 747.

KNOWLES, Sir Francis Charles.—" Improvements in the " manufacture of cast steel." Furnaces, either air or blast, are described "whereby the manufacture of cast steel from the ore " becomes a continuous operation." The furnace consists of two parts, " the outer or heating " and "inner or reducing, cementing, " and fluxing or smelting furnace." By separating the furnaces any fuel, however impure, may be used for heating.

Cast steel may be made directly from pure rich ores by using,—

1st, cyanide of potassium or sodium.

2ndly, cryolite or fluoride of sodium and aluminium.

3rdly, pure alumina or kaolin mixed with quicklime or caustic magnesian lime from magnesian limestone.

No. 2 is costly. It comes from Greenland, and is used when only a small portion of silica is present in the ores.

Directions are given as to the mode of using the fluxes and the proportions suited to various cases.

[Printed, 11*d.*]

A.D. 1857, March 21.—Nº 801.

MUSHET, Robert.—" Improvements in the manufacture of " cast steel." The application for Letters Patent was not proceeded with.

To improve the quality of cast steel, and make it closer and more even in character, a triple compound, formed by heating together iron, manganese, and carbon, is to be added to deoxidised iron ore by preference when in a molten fluid state.

[Printed, 3*d.*]

A.D. 1857, March 21.—N° 802.

MUSHET, ROBERT.—"Improvements in the manufacture of "cast steel." To remedy defects in manufactured steel arising from its being unsound, "a compound or mixture consisting of or "containing iron, carbon, and manganese," is added to the cast steel when both "are in a molten state, so that they may be mixed and combined with facility." The iron ores preferred are such as contain much manganese.

[Printed, 3*d*.]

A.D. 1857, March 23.—N° 808.

NORMANDY, LOUIS A. (junior).—"An improved process for "manufacturing iron." (*A communication.*) The application for Letters Patent was not completed.

Malleable iron is to be made in a puddling furnace directly from crude molten iron by treating the latter while falling in a divided state with currents of air.

[Printed, 3*d*.]

A.D. 1857, March 25.—N° 838.

CASSELS, ROBERT, and MORTON, THOMAS.—"Improvements in the manufacture of iron."

The Specification and Drawings describe a refinery furnace, having water chambers to preserve the hearth, and having six or any suitable number of tuyeres arranged for refining the iron, which may be run in directly from the cupola or other furnace.

[Printed, 10*d*.]

A.D. 1857, April 3.—N° 925.

BARKER, STEPHEN.—"Improvements in the manufacture of "steel." The application for Letters Patent was not proceeded with.

The invention is stated in the Provisional Specification to consist "in the manufacture of steel from wrought or malleable iron, "the said iron being in such a state of division as is possessed by "the waste pieces produced in the manufacture of various articles "of wrought iron," such as scraps, turnings, borings, &c.

[Printed, 3*d*.]

A.D. 1857, April 9.—Nº 1009.

ARMITAGE, William, and LEA, Henry.—" Improvements " in the manufacture of iron." The application for Letters Patent was not proceeded with.

When iron in a heated state is hammered to assist the refining thereof, it is proposed to bring "a current of air mixed with steam " into contact with the metal during the action of the hammer " thereon, whereby the quality of the iron is much improved," and the wear and tear of the tools employed is lessened.

[Printed, 3*d.*]

A.D. 1857, April 9.—Nº 1013.

HADDAN, John Coope.—" Improvements in the smelting and " refining of iron."

The Specification and Drawings describe smelting and refining furnaces which are worked in connection. By employing currents of air, steam, or gases, malleable iron and steel may be produced from the ore "without mixing with the ore any solid combustible." The ores are broken and placed in an ordinary smelting furnace, round which are arranged at a suitable height two to four " refining furnaces (similar to Bessemer's patent " refining furnaces);" contiguous is a reverberatory refining furnace. One or more close gas-generating furnaces are employed. The melted iron is run from the smelting furnace into the refining furnaces, and is there treated with currents of air, steam, or gases. The latter are introduced from the gas-generating furnaces, and subsequently pass off into the smelting furnace to heat its contents. The metal may be still further refined in the reverberatory refining furnace, which is likewise supplied with a portion of the heated gases.

[Printed, 6*d.*]

A.D. 1857, April 9.—Nº 1014.

HADDAN, John Coope.—" Improvements in the manufacture " of iron and steel." (*A communication.*) The application for Letters Patents was not proceeded with, the law officer having refused to grant provisional protection.

The Provisional Specification states that the invention consisst in the use of combustible gases, as hydrogen, oxide of carbon, carburetted hydrogen, &c. in the reduction of iron and other metals " in such a manner as that their use can be alternated

" (when required) with that of atmospheric air or steam without " accident or explosion."

[Printed, 3*d.*]

A.D. 1857, April 20.—N° 1113.

CLAY, **William.**—" Improvements in the manufacture of iron " and steel." The application for Letters Patent was not proceeded with.

The Provisional Specification states that the invention consists in improvements upon the invention described in the Specification of former Letters Patent, dated October 20, 1856. (See N° 2463, p. 241.) The open space above the molten metal in the furnace, as therein described, is to be covered and made air-tight, and air or gases forced under pressure through the molten metal.

An exhaust apparatus may also be combined therewith, and also with high cupolas or furnaces.

[Printed, 3*d.*]

A.D. 1857, May 11.—N° 1320.

SIEMENS, **Charles William.**—" Improvements in furnaces " and in the application of heated currents."

The Specification and drawings, which should be referred to, describe furnaces and mechanical arrangements for producing and applying heated currents to furnaces on the principle described in the Specification of former Letters Patent granted to Frederick Siemens. (See N° 2861, 1856, p. 245.)

In puddling and refining iron the metal is subjected at the requisite stages to oxygenous currents, when the iron is to part with its carbon, and to neutral or reducing currents when the operation of balling is going on. By the action of a system of valves the operator may, at pleasure, introduce currents through the heated " regenerators " inwards, or direct the products of combustion outwards.

[Printed, 2*s.* 8*d.*]

A.D. 1857, May 19.—N° 1404.

COWPER, **Edward Alfred.**—" Improvements in furnaces for " heating air and other elastic fluids." Chambers filled with fire-brick or other refractory substances, having interstices or channels between them, are inclosed in air-tight metal or other cases, and are used for heating the blast injected into blast or other furnaces. The chambers are called "regenerators," and are similar to those described in the specification of Frederick Siemens. (See N° 2861, 1858, ante, p. 245.)

Suitable valves and apparatus are described for directing products of combustion outwards through the "regenerators," and heating them, or for introducing currents of air which are highly heated on their passage inwards through the channels.

[Printed, 4*s*. 10*d*.]

A.D. 1857, May 20.—N° 1423.

ABBOT, James, the younger, THOMAS, Richard Handley, YOUNG, John, and HUNT, James Edward.—"Improved "machinery for blooming iron."

The Specification and Drawings describe two ribbed rollers, each revolving eccentrically in a strong ribbed case. The bloom is fed in by hand, or by suitable apparatus, as described at the wide opening of the first roller and case, and being passed out at the narrow end thereof, is still further rolled and compressed in the second roller and case. Suitable "upsetting pieces" are attached to the rolling mill, being inclined inwards, "which will prevent "the ball from rising, and will allow of lateral expansion of the "bloom."

[Printed, 1*s*. 4*d*.]

A.D. 1857, May 27.—N° 1512.

NEWTON, Alfred Vincent.—"Improved apparatus to be "used in the manufacture of iron." (*A communication.*)—An apparatus is connected with a puddling furnace consisting of a hollow stem, introduced through the roof, connected with a hollow cross arm which is moved by suitable machinery, and stirs and agitates the iron in the furnace. At the same time it injects, if requisite, currents of air or water among the agitated molten metal.

[Printed, 7*d*.]

A.D. 1857, June 13.—N° 1660.

MUSHET, Robert.—"Improvements in the manufacture of "cast steel." Metallic manganese is mixed with cast steel, by preference in the melting pots, in proportions of from one to five per cent., according to the hard or soft quality of steel required. The metallic manganese may be prepared by melting oxide of manganese in close vessels with fluor spar, soda, and common salt, or in any other convenient way. It may be introduced in the fluid steel enclosed in thin sheet iron, or in a melted state.

[Printed, 3*d.*]

A.D. 1857, June 15.—N° 1671.

NEWTON, William Edward.—" Improvements in puddling " iron," &c. (*A communication.*) A puddling furnace is described having a revolving bottom mechanically moved. Revolving tools are used to stir up the iron. These are actuated by suitable apparatus connected with the furnace. The tools may be made hollow, and so are used to inject currents of air into the mass of molten metal while it is being stirred and puddled.

[Printed, 9*d.*]

A.D. 1857, June 16.—N° 1683.

EDWARDS, William Alexander.—" Apparatus for sepa- " rating iron and other matters from ores," &c. The application for Letters Patent was not proceeded with.

The ores are pulverised, and a cylinder of iron, magnetised by means of a coil of wire, is made to revolve beneath a hopper, into which the pulverised ores are fed. As the magnetised cylinder revolves the ores fall upon it from the hopper, and the particles of iron are attracted to it, and so separated from the other matters.

[Printed, 3*d.*]

A.D. 1857, June 24.—N° 1759.

MORCOM, Richard. — " Improvements in dressing ores." Stamping apparatus is employed for crushing ores in which a rotatory motion is communicated to the stampers during the process of raising them, so that they are turned round, and are so made to wear equally on all sides.

[Printed, 6*d.*]

APPENDIX.

A.D. 1754, January 31.—N° 688.

JOHNSON, William.—"Double and single kettles, furnaces, "and boilers made of wrought-iron plate," &c. "Iron barrs" are to be hammered, and then rolled in an iron rolling mill to the requisite size. They are then worked by hand, and rivetted in the required shape.

[Printed, 3*d*.]

APPENDIX No. II.

A.D. 1670, December 1.—No. 161.

RUPERT, PRINCE.—Converting iron, when manufactured, into steel.

A speciall lycence graunted unto his Highness Prince Rupert, his executors, adm^{rs}, and assignes, to use his new invenc̄ons of converting into steele all manner of edged tooles, files, and other instruments, forged and formed in soft iron, or any part of the said tooles, files, and other instruments, after they are set, forged, and framed, as also all man̄er of iron wyre, after it is drawne, and of preparing and softening all cast and melted iron, soe that it may be filed and wrought as forged iron is, and of tinctureing of copper upon iron; to hold for 14 yeares according to the Statute in this case made and provided, rendering unto His Mat^{y} the yearly rent of 20^{s}; with such clauses and non-obstantes as are usuall in patients of this nature.—Teste R. apud Westm^{r}, 1mo die De^{bris}, anno p'd.

By writ, &^{c}.

A.D. 1671. January 8.—No. 162.

RUPERT, PRINCE.—Administration of oath of secresy.

Whereas His Maj^{y} was lately pleased to grant unto his Highnes Prince Rubert the sole liberty of useing his new invenc̄ons for converting into steele all man̄er of edge tooles, files, and other instruments, forged and formed in soft iron, or any part of the said tooles, files, and other instruments so forged and formed, and alsoe for the converting all manner of iron wyre after it is drawne, &^{c}, for the term of 14 yeares from the sixth day of May last. His Maj^{y} doth hereby authorize and empower his said Highness Prince Rupert, Anthony Lord Ashley, and S^{r} Thomas Chickley, not only to take security, but also to adm̄ster an oath to the severall workmen, artificers, and persons concerned in the said arts and invenc̄ons, neither directly nor indirectly to divulge or make known to any p'son or persons whatsoever, except His Maj^{y}, his heirs or successors, the said arts or invenc̄ons, or any of them, or how they are used or exercised, or with what instrum^{ts} or materialls the same are made and wrought.—Teste R. apud Westm^{r}, 8vo Jañ, anno p'd.

By writt, &^{c}.

A.D. 1849, August 9.—N° 12,735.

FURNESS, WILLIAM.—Machinery for cutting wood, &c., and "sharpening and grinding tools or surfaces, and also in "welding steel to cast iron."

The Specification, after describing machinery for working wood, describes a grinding machine for grinding knives and other surfaces. Also a mode of welding steel to cast iron, by making the surface of the steel clean and bright, and pouring upon it molten iron. A small quantity of powdered calcined borax may be sprinkled on the steel.

[Printed, 6*s*.]

A.D. 1853, November 1.—N° 2521.

CROWLEY, JOHN.—"Improvements in the construction of ovens "and furnaces."

The Specification and drawings describe ovens for annealing metal castings, which are placed in pots or cases, made of fire-brick or fire-stone, lined with cast or wrought iron, and supported on arches.

Furnaces for converting iron into steel are made with flues descending between and passing under the pots or cases wherein the iron is converted.

Self-acting machinery is used for regulating the opening of the dampers of the furnace according to the volume of smoke evolved.

[Printed, 10½*d*.]

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